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SECOND BROAD RIVER WATERSHED

aTC425

.S42U5

Work Plan

MCDOWELL, RUTHERFORD, AND CLEVELAND
COUNTIES, NORTH CAROLINA



U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE
FOREST SERVICE

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ADDENDUM

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Second Broad River Watershed
McDowell, Rutherford, and Cleveland Counties, North Carolina
CATALOGING - PREP

This addendum is prepared to present information consistent with the intent of the Principles and Standards for Planning Water and Related Land Resources which became effective October 30, 1973. The information presented is: Part I - Benefit to Cost Comparison; Part II - Abbreviated Four Account Displays; and Part III - Abbreviated Environmental Quality Plan.

PART I

The project costs, benefits, and benefit-cost ratio are based on a 6 - 1/8 percent interest rate, current normalized prices, and the 1974 price base. Annual project costs, annual benefits, and benefit-cost ratio are as follows:

1. Project costs \$448,000
2. Project benefits. \$700,400
3. Benefit-cost ratio. 1.6 to 1.0
4. Benefit-cost ratio without
secondary benefits 1.4 to 1.0

PART II

Selected Plan

NATIONAL ECONOMIC DEVELOPMENT ACCOUNT

Second Broad River Watershed, North Carolina

<u>Components</u>		<u>Measures of Effects^{1/}</u>	<u>Components</u>	<u>Measures of Effects^{1/}</u>
Beneficial Effects:			Adverse Effects:	
A. The value to users of increased outputs of goods and services			A. The value of resourcea required for a plan	
1. Flood prevention	\$197,900		1. Ten floodwater retarding structures and two multiple-purpose structures	
2. Recreation	220,000			
3. Utilization of unemployed and underemployed resources	57,100			
Total beneficial effects	475,000		a. Project inatallstion	\$350,035
			b. Project administration	38,180
			c. Operation and maintenance	43,500
			Total adverse effects	\$431,715
			Net beneficial effects	\$ 43,285

1/ Average annual benefits and costs @ 5 7/8 percent interest

January 1975

Selected Plan

ENVIRONMENTAL QUALITY ACCOUNT

Second Broad River Watershed, North Carolina

Components

Beneficial and adverse effects:

A. Areas of natural beauty

Measures of Effects

1. Project output will make available regional funds and resources that can be used to enhance the physical appearance of 18,540 acres of cropland, grassland, and miscellaneous land, as well as 24,223 acres of forestland.
 2. Create 12 lakes in the headwaters of Second Broad River, ranging in size from 7 to 155 surface acres, totaling 470 surface acres.
 3. Stabilize 430 acres of critically eroding land.
 4. Inundate 470 acres of land (216--crop and pasture; 254--forestland), and 10 miles of streams.
- B. Quality considerations of water and land resources.
1. Reduce sediment and erosion by 30 percent.
 2. Reduce sediment transported to the mouth of the watershed by 21,150 tons (65 mg/l) annually.
 3. Reduce sediment associated pollutants.
 4. Temporarily increase sedimentation during construction.
- C. Biological resources and selected ecosystems.
1. Create 19 acres of managed waterfowl feeding area.
 2. Create 470 surface acres of fish habitat.
 3. Provide 323 acres of managed upland wildlife habitat.
 4. Provide 470 surface acres for migratory waterfowl resting areas.
 5. Eliminate approximately 470 acres of wildlife habitat.
- D. Cultural resources
- E. Irreversible or irretrievable commitments.
1. Make archaeological survey of 1,050 acres.
 1. Commit 470 acres, which is now 216 acres of crop and pasture land and 254 acres of forestland to permanent water.
 2. Commit approximately 80 acres, which is now mainly forestland, to dams and spillways.
 3. Prevent the construction of buildings in the flood pools of the structures (465 acres).
 4. Commit the labor, materials, and energy required for construction of project measures to water resource development.

Selected Plan

REGIONAL DEVELOPMENT ACCOUNT

Second Broad River Watershed, North Carolina

		<u>Components</u>		<u>Measures of Effects</u> <u>Region</u> ^{1/} <u>Rest of Nation</u>		<u>Components</u>		<u>Measures of Effects</u> <u>Region</u> ^{1/} <u>Rest of Nation</u>	
A. Income:		A. Income:				A. Income:			
Beneficial Effects:		Beneficial Effects:				Adverse Effects:			
1. The value of increased output of goods and services to users residing in the region.		1. The value of resources contributed from within the region to achieve the outputs.				1. The value of resources contributed from within the region to achieve the outputs.			
a. Flood prevention		a. Ten floodwater retarding structures and two multiple-purpose structures, with		\$197,900					
b. Recreation				220,000					
c. Utilization of unemployed and underemployed resources				57,100					
d. Secondary				56,400					
Total Beneficial Effects				\$531,400		Project installation (structural measures)		\$114,420	\$235,615
						Project administration		1,425	36,755
						Operation and maintenance		43,500	
B. Employment:						Total Adverse Effects		\$159,345	\$272,370
Beneficial Effects:		Beneficial Effects:				Net Beneficial Effects		\$372,055	-\$272,370
1. Increase in the number and types of jobs.		1. Decrease in number and types of jobs				B. Employment:			
a. Due to increase in agricultural output.		a. Due to increase in agricultural output.		23 permanent semi-skilled jobs.		Adverse Effects:			
b. Employment for project construction.		b. Employment for project construction.		79 man-years of semi-skilled employment during installation period (7 yrs.)		1. Decrease in number and types of jobs		0	
c. Employment for project operation and maintenance		c. Employment for project operation and maintenance		6 permanent semi-skilled jobs.		Total Adverse Effects		0	
Total Beneficial Effects		Total Beneficial Effects		29 permanent semi-skilled job.		Net Beneficial Effects		29 permanent semi-skilled jobs.	
				79 man-years of semi-skilled employment over installation period (7 yrs.)				79 man-years of semi-skilled employment over the installation period (7 yrs.)	

^{1/} Average annual

^{2/} The region consists of McDowell, Rutherford, and Cleveland Counties, North Carolina

January 1975

SELECTED PLAN

REGIONAL DEVELOPMENT ACCOUNT (Continued-2)

Second Broad River Watershed, North Carolina

<u>Components</u>	<u>Measures of Effects</u> <u>Region</u> ^{1/} / <u>Rest of Nation</u>	<u>Components</u>	<u>Measures of Effects</u> <u>Region</u> ^{1/} / <u>Rest of Nation</u>
C. Population Distribution		C. Population Distribution	
Beneficial Effects:	Create 29 permanent semi-skilled jobs and 79 man-years of semi-skilled employment over the installation period (8 yrs.)	Adverse Effects	--
D. Regional Economic Base and Stability:		D. Regional Economic Base and Stability	
Beneficial Effects:	Reduce floodwater damages by 68 percent, and sediment damages by 59 percent. Provide 152,000 visitor-days of recreation annually. Create 29 permanent semi-skilled jobs and 79 man-years of employment for regional labor over the installation period (8 yrs.)	Adverse Effects:	--

1/ The region consists of McDowell, Rutherford, and Cleveland Counties, North Carolina

Date: January 1975

Selected Plan

SOCIAL WELL-BEING ACCOUNT

Second Broad River, North Carolina

Components

Measures of Effects

Beneficial and adverse effects:

- | | |
|-------------------------------|---|
| A. Real income distribution | 1. Create 29 permanent semi-skilled jobs and 79 man-years of semi-skilled employment over the installation period (7 years).

2. Information concerning the income distribution effects of this project was not developed during planning.

3. The local costs of project installation totaling \$1,955,806 will be provided by the Rutherford County Watershed Commission. Annual operation and maintenance costs amounting to \$43,500 will also be provided by the commission. The distribution of these costs by income class is not readily available. |
| B. Life, health, and safety | 1. Provide protection from at least the 25-year storm to 12 bridges which are just downstream from structures, thereby improving the usefulness and safety of public highways and bridges. |
| C. Recreational opportunities | 1. Provide 152,000 visitor-days of recreation in pools of multiple-purpose structures. |
| D. Cultural resources | 1. Provide opportunity for study of archaeological sites at structures. |

January 1975

PART III

ABBREVIATED ENVIRONMENTAL QUALITY PLAN

Second Broad River Watershed
Rutherford, McDowell, and Cleveland Counties, North Carolina

Environmental Quality Problems

Second Broad River Watershed, located in Rutherford, McDowell, and Cleveland Counties, North Carolina, is an area featuring a mixture of urban and agriculture. Industrial growth and urbanization are taking place at a fast rate. Agriculture has been in a transition period for several years in shifting from a strong dependence on crop production to an increased importance of livestock production.

Flooding is one of the most serious environmental quality problems of the watershed. It adversely affects practically all the area's resources. Agricultural crops grown on the bottomlands are subject to severe damage from flooding. The aesthetic value of bottomland fields is deteriorating through flood plain scour, overbank deposition, and gully erosion. Several homes and businesses suffer damages from high water. In addition, flooding interferes with public transportation through washout of bridges or blockage of roads due to high water. Fish and wildlife resources are affected also. The high water washes debris and trash into the streams, creating potential water pollution problems. Flooding during some seasons of the year poses a hazard to the reproduction of small game species.

Erosion on open land and in some forested areas is another serious environmental quality problem. Not only does erosion reduce the productivity of the land but also decreases the aesthetic value by creating unsightly gullies, rills, etc. If severe erosion on cropland is left unchecked, it gradually forces the land to be relegated to other uses.

If these abandoned fields are left idle, the erosion problem worsens and critical sediment source areas are produced. Often these abandoned areas become the location of ugly garbage dumps and trash piles. Many acres of cropland in the watershed have already been abandoned due to uncontrolled erosion.

Sediment associated with the erosion problem is a third serious environmental quality problem of the watershed. It causes channels to fill up and be less efficient in transporting water, thus increasing flooding problems. Overbank deposition of infertile material during flooding damages agricultural productivity as well as decreasing the natural beauty of bottomland fields. Sediment also carries dangerous farm chemicals such as pesticides and insecticides. Fertilizer nutrients applied to

agricultural crops are likewise lost from fields to waterways as attached to sediment particles. Not only are the field crops robbed of needed nutrients, but these nutrients getting into waterways contribute to nuisance algal blooms in ponds and lakes. These algal blooms decrease the lake's aesthetic value and can lead to fish kills when very intense. Turbid water has an adverse effect on fish and other aquatic organisms in the watershed streams. In fact, sediment has been cited as the most serious problem encountered by the fishery resources of the piedmont streams.

The lack of public water-based recreational facilities is a factor affecting the quality of life for watershed residents. Although there are other types of recreation available (golf, bowling, etc.) around urban areas, only two small lakes (both total seven acres) are available to watershed residents for public fishing. The only other public water-based recreation is fishing in the streams where access is possible at road crossings. As the watershed population increases in the future, more and more energy will be consumed and air pollution created as watershed residents travel long distances seeking boating, skiing, and fishing opportunities.

The watershed is in a previously untouched archaeological zone. No archaeological or historical surveys have been performed prior to the initiation of the planning of the watershed project.

Needs for Solving Environmental Quality Problems

Component needs for solving problems relating to specific environmental conditions are listed below:

1. Human Resources
 - a. Provide publicly accessible water-based recreational opportunities.
 - b. Reduce interruptions of traffic caused by flood damage to roads and bridges.
 - c. Maintain natural areas where urban dwellers can have a chance to get out and enjoy nature.
 - d. Prevent destruction of homes, businesses, and sources of livelihood from flooding.
 - e. Prevent future damages to homes, businesses, etc., resulting from flood plain encroachment.
2. Water, Land and Air Resources
 - a. Reduce erosion damage on cropland.
 - b. Stabilize unsightly critical sediment source areas.
 - c. Reduce damages to bottomlands resulting from overbank deposition and flooding.

- d. Improve quality of water in Second Broad River through reduction of sediment and associated pollutants.
 - e. Improve air quality through reduction of dust associated with dirt roads.
3. Biological Resources and Ecosystems
- a. Preserve the waterfowl habitat at the Bostic brickyard.
 - b. Develop additional waterfowl habitat.
 - c. Improve habitat for upland game through a management program to provide a dependable food supply, avoid destruction of habitat, and prevent damages to wildlife habitat from urban encroachment.
 - d. Improve fishery resources through reduction in sediment and sediment-associated pollutants.
 - e. Maintain and enhance the smallmouth bass habitat on Second Broad River.
 - f. Develop additional fish habitat.
 - g. Protect any rare, endangered, or threatened species that might exist within the watershed.
4. Archaeological and Historical Resources
- a. Carry out thorough search around works of improvement to locate any such resources of this type.
 - b. Make necessary provisions for salvaging or preserving such resources if they are found.

Components of Environmental Quality Plan

The first component of the plan would be the initiation of an accelerated conservation land treatment program over the watershed. This program would be very similar to the land treatment program of the selected plan. Cropland measures would include conservation cropping systems, contour farming, terracing, crop residue use, and others. Forestry measures would include tree planting, stand improvement measures, and managed harvest programs. Grassland measures would include pasture planting, pasture renovation, and managed grazing. Critical sediment source areas will be stabilized also.

A system of 12 structures will be constructed in the same location as the structures in the selected plan. However, only one will be multiple-purpose. This structure will be the same as Structure No. 2 of the selected plan. It will also have a complete recreational development similar to the development around Structure No. 2 of the selected plan. Public access will be provided at all 12 of the structures. Wildlife foods (both upland wildlife foods and duck foods) will be planted around the edge of all structures except the multiple-purpose reservoir. In addition, all structures, with the exception of the multiple-purpose, will have a "duck window" installed in the principal spillway for water level management. All 12 structures will have minimum flow orifices and bottom water release devices installed to protect and maintain downstream fishery habitat.

Sediment basins will be constructed on major laterals to Second Broad River, Cane Creek, Camp Creek, Catheys Creek, Robinson Creek, and Gilkey Creek. These traps will be constructed so that most of the coarse material drops out of the drainage water before entering these streams. The basins will be inspected regularly and cleaned out as needed. Approximately 100 basins will be required.

The particular reach of Second Broad River that contains the smallmouth bass fishery will be placed under a management program. This program will include the prevention of pollution, the enforcement of fishing regulations, and the preservation of fish habitat within the stream. A wildlife access area open to the public will be provided to this section of the stream. Sanitary facilities will be constructed at the access area.

An investigation to determine if any rare, endangered, or threatened plant and animal species exist within the watershed will be made prior to any construction. If any are found, provisions will be made for their preservation.

In order to reduce dust and air pollution and reduce sediment getting into watershed streams, about 100 miles of dirt and gravel roads will be paved. Paving will be done by the county governments and will meet minimum requirements of the North Carolina Department of Transportation and Highway Safety. Any unstable roadbanks will be vegetated or otherwise stabilized.

A search for any archaeological and historic resources will be made prior to the initiation of construction of any structural measures. This will likely be done under a contract with the North Carolina Department of Archives and History. If any resources are located, special provisions will be made for their salvage or preservation. Modifications of planned structural measures may be necessary to properly preserve the resource for present and future generations.

Flood plain management along all major streams in the watershed will be initiated. The flood plain would be managed for recreation, most forms of agriculture, wildlife areas, etc. Encroachment by damage-prone uses, such as urban build-up would be prevented. The county and city governments

would be responsible for this program. Buildings and businesses which are already in the flood plains will be flood-proofed if possible and practical. If this cannot be done, relocation of some of the houses will be considered.

The total estimated cost of the environmental quality plan is \$12,722,730. Following are costs for the individual elements of the environmental quality plan:

11 single-purpose floodwater retarding structures - - - -	\$ 4,400,800
Multiple-purpose structure - - - - -	919,500
Recreational development - - - - -	462,850
Land treatment program - - - - -	2,151,080
Smallmouth bass habitat development and access area - - - -	13,000
Investigation for rare and endangered species- - - - -	20,000
Search for archaeological and historical resources - - - -	6,000
Wildlife plantings (other than associated with land treatment program) - - - - -	55,000
Paving 100 miles of dirt roads- - - - -	4,000,000
Flood-proofing buildings in flood plains- - - - -	100,000
Project administration - - - - -	594,500
Total	\$12,722,730

Environmental Effects

The effects on the various resources that would result from installation of the environmental quality plan are as follows:

1. Human Resources

- a. Provide publicly accessible water-based recreation.
- b. Reduce flood damages to homes, businesses, etc.
- c. Prevent future damages to homes, businesses, etc., through flood plain management.
- d. Reduce interruptions of traffic and other activities resulting from washed out bridges, flooded roads, etc.
- e. Provide urban dwellers an opportunity to enjoy natural settings.

2. Fish and Wildlife Resources

- a. Improve fishery resources through a reduction in sediment and associated pollutants.

- b. Create 470 acres of new fish habitat.
- c. Maintain and enhance smallmouth bass population in Second Broad River.
- d. Maintain and enhance waterfowl habitat around the Bostic brickyard borrow pits.
- e. Create new waterfowl habitat around 11 of the structures.
- f. Improve upland wildlife through food plantings around 11 of the structures, new upland wildlife habitat development as part of the land treatment program, and conservation practices on cropland which provide incidental benefits to wildlife (e. g. field borders, stripcropping).
- g. Avoid destruction of any rare, endangered, or threatened species that might exist in the watershed.
- h. Improve quality of fish habitat below structures through sediment reduction, low flow augmentation, and cold water release features of the structures.

3. Water, Land, and Air Resources

- a. Improve quality of water in Second Broad River and tributaries through reduction in sediment and associated pollutants.
- b. Reduce erosion on agricultural lands, thus helping to insure their future productivity.
- c. Maintain and improve the aesthetic value of farmland through the application of conservation practices.
- d. Stabilize critical sediment source areas.
- e. Reduce dust and air pollution associated with dirt and gravel roads.
- f. Provide greater diversity of landscape by superimposing the structures into the rolling to mountainous topography of the watershed.

4. Archaeological and Historic Resources

- a. Avoid destruction of such resources by construction of works of improvement.
- b. Provide for salvage or development of such resources if they are found.

WATERSHED WORK PLAN

SECOND BROAD RIVER WATERSHED -
Rutherford, McDowell, and Cleveland Counties, North Carolina

Prepared Under the Authority of the Watershed
Protection and Flood Prevention Act
(Public Law 566, 83rd Congress, 68 Stat. 666),
as amended

Prepared by:

Rutherford County Watershed Commission
Rutherford Soil and Water Conservation District
McDowell Soil and Water Conservation District

With assistance by

United States Department of Agriculture
Soil Conservation Service

United States Department of Agriculture
Forest Service

AUGUST 1975

WATERSHED WORK PLAN AGREEMENT

between the

Rutherford County Watershed Commission
Local Organization

Rutherford Soil and Water Conservation District
Local Organization

McDowell Soil and Water Conservation District
Local Organization

(hereinafter referred to as the Sponsoring Local Organization)

State of North Carolina

and the

Soil Conservation Service
United States Department of Agriculture
(hereinafter referred to as the Service)

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsoring Local Organization for assistance in preparing a plan for works of improvement for the Second Broad River Watershed, State of North Carolina, under the authority of the Watershed Protection and Flood Prevention Act (P. L. 566, 83d Congress; 68 Stat. 666), as amended; and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to the Service; and

Whereas, there has been developed through the co-operative efforts of the Sponsoring Local Organization and the Service a mutually satisfactory plan for works of improvement for the Second Broad River Watershed, State of North Carolina, hereinafter referred to as the watershed work plan, which plan is annexed to and made a part of this agreement;

Now, therefore, in view of the foregoing considerations, the Sponsoring Local Organization and the Secretary of Agriculture, through the Service, hereby agree on the watershed work plan, and further agree that the works of improvement as set forth in said plan can be installed in about eight years.

It is mutually agreed that in installing and operating and maintaining the works of improvement substantially in accordance with the terms, conditions, and stipulations provided for in the watershed work plan:

1. The Rutherford County Watershed Commission will acquire such land rights as will be needed in connection with works of improvement. (Estimated cost \$1,545,200). The percentages of this cost to be borne by the Sponsoring Local Organization and the Service are as follows:

<u>Works of Improvement</u>	<u>Sponsoring Local Organization (percent)</u>	<u>Service (percent)</u>	<u>Estimated Land Rights Costs (dollars)</u>
Multiple-purpose Str. No. 2 and Recreational Facilities:			
Payment to landowners for about 430 acres	50	50	172,000
Cost of alteration or modifica- tion of improvements*	50	50	200,000
Legal fees, survey costs, flowage easements, and other	100	0	7,000
All Other Structural Measures	100	0	1,166,200

*Including necessary engineering services, construction, and additional land costs.

The Rutherford County Watershed Commission agrees that all land acquired of or improved with Public Law 566 financial or credit assistance will not be sold or otherwise disposed of for the evaluated life of the project, except to a public agency which will continue to maintain and operate the development in accordance with the Operation and Maintenance Agreement.

2. The Rutherford County Watershed Commission assures that comparable replacement dwellings will be available for individuals and persons displaced from dwellings, and will provide relocation assistance advisory services and relocation assistance, make the relocation payments to persons, and otherwise comply with the real property acquisition policies contained in the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646, 84 Stat. 1894) effective as of January 2, 1971, and the Regulations issued by the Secretary of Agriculture pursuant thereto. The costs of relocation payments will be shared by the Sponsoring Local Organization and the Service as follows:

	<u>Sponsoring Local Organization</u> (percent)	<u>Service</u> (percent)	<u>Estimated Relocation Payment Costs</u> (dollars)
Relocation Payments	42.8	57.2	62,000

The Rutherford County Watershed Commission will acquire or provide the assurance that landowners or water users have acquired such water rights pursuant to state law as may be needed in the installation and operation of the works of improvement.

The percentages of construction costs of structural measures to be paid by the Rutherford County Watershed Commission and by the Service are as follows:

<u>Works of Improvement</u>	<u>Sponsoring Local Organization</u> (percent)	<u>Service</u> (percent)	<u>Estimated Construction Cost</u> (dollars)
Multiple-purpose Str. No. 2	22.64	77.36	530,000
Recreational Development	50.00	50.00	462,850
Multiple-purpose Str. No. 3A	30.05	69.95	490,000
Recreational Facilities	100.00	0	10,500
Floodwater Retarding Structures	0	100.00	2,468,700

Critical area stabilization measures are to be installed on a division of work basis between the Service and the Sponsoring Local Organization. The Rutherford County Watershed Commission will provide for the labor and equipment and the Service will provide the needed materials.

The percentages of the engineering costs to be borne by the Rutherford County Watershed Commission and the Service are as follows:

<u>Works of Improvement</u>	<u>Sponsoring Local Organization</u> (percent)	<u>Service</u> (percent)	<u>Estimated Engineering Cost</u> (dollars)
Multiple-purpose Str. No. 2	0	100	42,500
Recreational Development	50	50	46,300
Multiple-purpose Str. No. 3A	0	100	39,000
Recreational Facilities	100	0	1,050
Floodwater Retarding Structures	0	100	239,700

6. The Rutherford County Watershed Commission and the Service will each bear the costs of project administration which it incurs, estimated to be \$24,200 and \$623,500, respectively.
7. The Rutherford and McDowell Soil and Water Conservation Districts will obtain agreements from owners of not less than 50 percent of the land above each reservoir and floodwater retarding structure that they will carry out conservation farm or ranch plans on their land.
8. The Rutherford and McDowell Soil and Water Conservation Districts will provide assistance to landowners and operators to assure the installation of the land treatment measures shown in the watershed work plan.
9. The Rutherford and McDowell Soil and Water Conservation Districts will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.
10. The Rutherford County Watershed Commission will be responsible for the operation and maintenance of the structural works of improvement by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.
11. The costs shown in this agreement represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.
12. This agreement is not a fund obligating document. Financial and other assistance to be furnished by the Service in carrying out the watershed work plan is contingent on the availability of appropriations for this purpose.

A separate agreement will be entered into between the Service and the Sponsoring Local Organization before either party initiates work involving funds of the other party. Such agreement will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

13. The watershed work plan may be amended or revised, and this agreement may be modified or terminated only by mutual agreement of the parties hereto except for cause. The Service may terminate financial and other assistance in whole, or in part, at any time whenever it is determined that the Sponsoring Local Organization has failed to comply with the conditions of this agreement. The Service shall promptly notify the Sponsoring Local Organization in writing of the determination and the reasons for the termination, together with the effective date. Payments made to the Sponsoring Local Organization or recoveries by the Service under projects terminated for cause shall be in accord with the legal rights and liabilities of the parties.

14. No member of or delegate to congress, or resident commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.
15. The program conducted will be in compliance with all requirements respecting nondiscrimination as contained in the Civil Rights Act of 1964 and the regulations of the Secretary of Agriculture (7 C.F.R. 15.1-15.12), which provide that no person in the United States shall, on the ground of race, color, or national origin, be excluded from the participation in, be denied the benefits of, or be subjected to discrimination under any activity receiving federal financial assistance.
16. This agreement will not become effective until the Service has issued notification of approval and authorizes assistance.

Rutherford County Watershed
Commission

Box 368 Local Organization

Rutherfordton N.C. 28139

Address Zip Code

By [Signature]

Title Chairman

Date 10-21-75

The signing of this agreement was authorized by a resolution of the governing body of the Rutherford County Watershed Commission

Local Organization

adopted at a meeting held on 10-21-75

[Signature]
Secretary, Local Organization

Box 368
Rutherfordton N.C. 28139

Address

Zip Code

Date 10-21-75

MCDOWELL SWCD

P. O. BOX 129 Organization

MARION, N. C. 28752

Address Zip Code

By [Signature]

Title Chairman

Date 10-22-75

The signing of this agreement was authorized by a resolution of the governing body of the _____

Local Organization

adopted at a meeting held on _____

[Signature]
Secretary, Local Organization

MCDOWELL SWCD

P.O. BOX 129 Zip Code

MARION, N. C. 28752

Date 10-22-75

Rutherford Soil and Water Conservation District By James M. McVey
Local Organization
Box 315: Rutherford, N.C. 28139 Title Chairman
Address Zip Code Date 10-22-75

The signing of this agreement was authorized by a resolution of the governing body of the Rutherford Soil and Water Conservation District
Local Organization

adopted at a meeting held on _____

Donald B. Morrison Box 315: Rutherford, N.C. 28139
Secretary, Local Organization Address Zip Code
Date 10-22-75

Appropriate and careful consideration has been given to the environmental statement prepared for this project and to the environmental aspects thereof.

Soil Conservation Service
United States Department of Agriculture

Approved by:

James L. Hicks
State Conservationist
10-28-75
Date

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WATERSHED WORK PLAN

Second Broad River Watershed
McDowell, Rutherford, and Cleveland Counties, North Carolina

August 1975

SUMMARY OF PLAN

The Second Broad River Watershed, consisting of 144,300 acres, is located in McDowell, Rutherford, and Cleveland Counties, North Carolina. Sponsors of the project are Rutherford County Watershed Commission, Rutherford Soil and Water Conservation District, and McDowell Soil and Water Conservation District.

Erosion with associated sediment damage, flooding of agricultural cropland and pastureland, low income, lack of public recreational facilities, and poor management of fish and wildlife and forest resources are the main problems of this watershed that will be dealt with under the plans of this watershed project.

Land treatment is of major importance in this plan, as about 70 percent of the cropland in the watershed is in need of some type of conservation treatment. There are also 430 acres of sediment producing areas. The plan proposes an accelerated land treatment program on 18,540 acres of cropland, grassland, and miscellaneous land, and forest land treatment measures on 24,223 acres.

Land treatment measures will vary from vegetative type practices (crop residue use, stripcropping, etc.) to mechanical type measures (diversions, grassed waterways, etc.). Conservation measures on forestland consist of tree plantings, harvest cutting, and stand improvement.

Technical assistance for planning and installing land treatment measures on open land will be provided by the Soil Conservation Service through the Rutherford and McDowell Soil and Water Conservation Districts. Technical assistance for applying forestry measures on private land will be furnished by the U. S. Forest Service in co-operation with the N. C. Division of Forest Resources. The landowners and operators will maintain land treatment measures under agreement with the Rutherford and McDowell Soil and Water Conservation Districts.

Structural measures planned consist of two multiple-purpose structures and ten floodwater retarding structures. A complete recreational development will be constructed at multiple-purpose Structure No. 2. Minimum recreational facilities will be constructed in connection with multiple-purpose Structure No. 3A.

Summary

This project will be installed over an eight-year period.

The project will reduce gross erosion by 30 percent. Overbank sediment deposition damages will be reduced 60 percent. Sediment damages to reservoirs will be reduced 55 percent and sediment damages to industrial water supplies will be reduced 35 percent. Flooding damages to crop and pasture land and other agricultural property will be reduced by 65 percent. Sediment transported to the mouth of the watershed will be reduced by 21,150 tons (65 mg/l) annually. In addition to increasing income of the watershed residents, the project will also create 79 man-years of employment during installation and 29 jobs over the project life. Ten miles of stream will be converted to 470 acres of fishery habitat in the structures. Three hundred twenty-three acres of managed upland wildlife habitat and 19 acres of managed wetland wildlife habitat will be created. The ten miles of stream to be converted to the reservoirs will be lost as stream fishery habitat, as will the 470 acres to be inundated be lost as wildlife habitat. Sedimentation will be temporarily increased during construction.

An archaeological survey was made to determine if any archaeological or historic sites would be significantly affected by the planned project.

The total project cost is estimated to be \$8,908,680 of which \$5,087,084 will be paid by Public Law 566 and \$3,821,596 will be paid by other funds. The land treatment program will constitute \$2,323,180 of the cost.

Land treatment measures on open land will be maintained by the landowners and operators of the land. Forest land treatment measures will also be maintained by the landowners and operators under agreement with the Rutherford and McDowell Soil and Water Conservation Districts. The Rutherford County Watershed Commission will be responsible for the operation and maintenance of the structural measures. They may carry out the operations with their staff or enter into agreements with other entities to carry out the necessary activities.

The average annual cost of the project will be \$388,215. Operation and maintenance costs will be an additional \$43,500, giving a total annual cost of \$431,715. When this is compared to the average annual benefits (\$531,400), this gives a benefit-cost ratio of 1.2 to 1.0.

WATERSHED RESOURCES - ENVIRONMENTAL SETTING

Physical Data

About 144,300 acres in size, the watershed is located in the southwestern part of North Carolina in Rutherford, McDowell and Cleveland Counties and is part of the Santee River Basin. Approximately 124,100 acres are in Rutherford County, 19,500 in McDowell County, and 700 in Cleveland County. The towns of Caroleen and Cliffside are located entirely in the watershed with portions of the towns of Rutherfordton (population 3,245) (1), Spindale (population 3,848) (1), and Forest City (population 7,179) (1) also located within the watershed. Asheville (population 57,681) (1) lies about 50 miles northwest, and Spartanburg, South Carolina, (population 44,352) (2) is about 30 miles south.

The watershed is located in subregion 0305 of the South Atlantic Gulf Water Resources Region as defined by the Water Resources Council (3). (See Figure 1). The 276,000 square miles of the region extend from the North Carolina-Virginia boundary line at the Atlantic Ocean to the mouth of Lake Pontchartrain on the Gulf of Mexico in Louisiana (4). It encompasses parts of North Carolina, Georgia, Alabama, Louisiana, Mississippi, and all of South Carolina and Florida. Climatic characteristics include well-distributed rainfall, mild winters, and warm-to-hot humid summers and average rainfall varying from over 80 inches in the mountains to 44 inches in central Georgia. Annual natural runoff ranges from 10.5 inches to 20.8 inches among the subregions; however, variations of individual river basins may be considerable. The quality of streams in the region is generally excellent although turbidity and color sometimes impair water physical quality in the coastal plain and moderate to sometimes high sediment loads are common. The quality of ground water is suitable for most uses; however, the yield varies considerably, depending on the type aquifer and the location within the region. In addition, the topography differs considerably throughout the region from rugged densely wooded mountains to rolling, well-drained plains to flatlands, wetlands, and marshes.

Subregion 0305 is made up of the Santee and Edisto River Basins in North and South Carolina (3). It is representative of the range of conditions in the region as a whole. The subregion varies from mountains to piedmont to coastal plain, and there is a wide range in characteristics of water resources.

Typical of the upper piedmont in the South Atlantic Gulf Region and Subregion 0305, the watershed has average annual precipitation of nearly 50 inches according to the weather station at Caroleen in the southern part of the watershed (5). The average temperature ranges from about 43 degrees Fahrenheit in January to around 79 degrees Fahrenheit in July, with an average annual temperature of approximately 60 degrees Fahrenheit (6). The average freeze-free period extends approximately from the middle of April to the middle of October (6).

The topography is mountainous in the upper 20 percent of the watershed and rolling to steeply rolling in the lower 80 percent. Valleys are narrow and have a high gradient, and hard rock ledges across the valleys prevent channel degradation. Some of the ridges in the watershed are 1,000 to 1,300 feet above the valley floor. Elevations generally range from about 700 feet mean sea level at the confluence of Second Broad and Broad Rivers up to about 2,200 feet in the mountainous headwaters. The upper portion of the watershed is in the Blue Ridge land resources area, and the lower portion is in the Southern Piedmont land resources area.

All of the land in the watershed is in private or industrial ownership. Industrial forestry concerns own and manage 6,800 acres of the 94,693 acres of forestland, the remainder being in non-industrial private holdings.

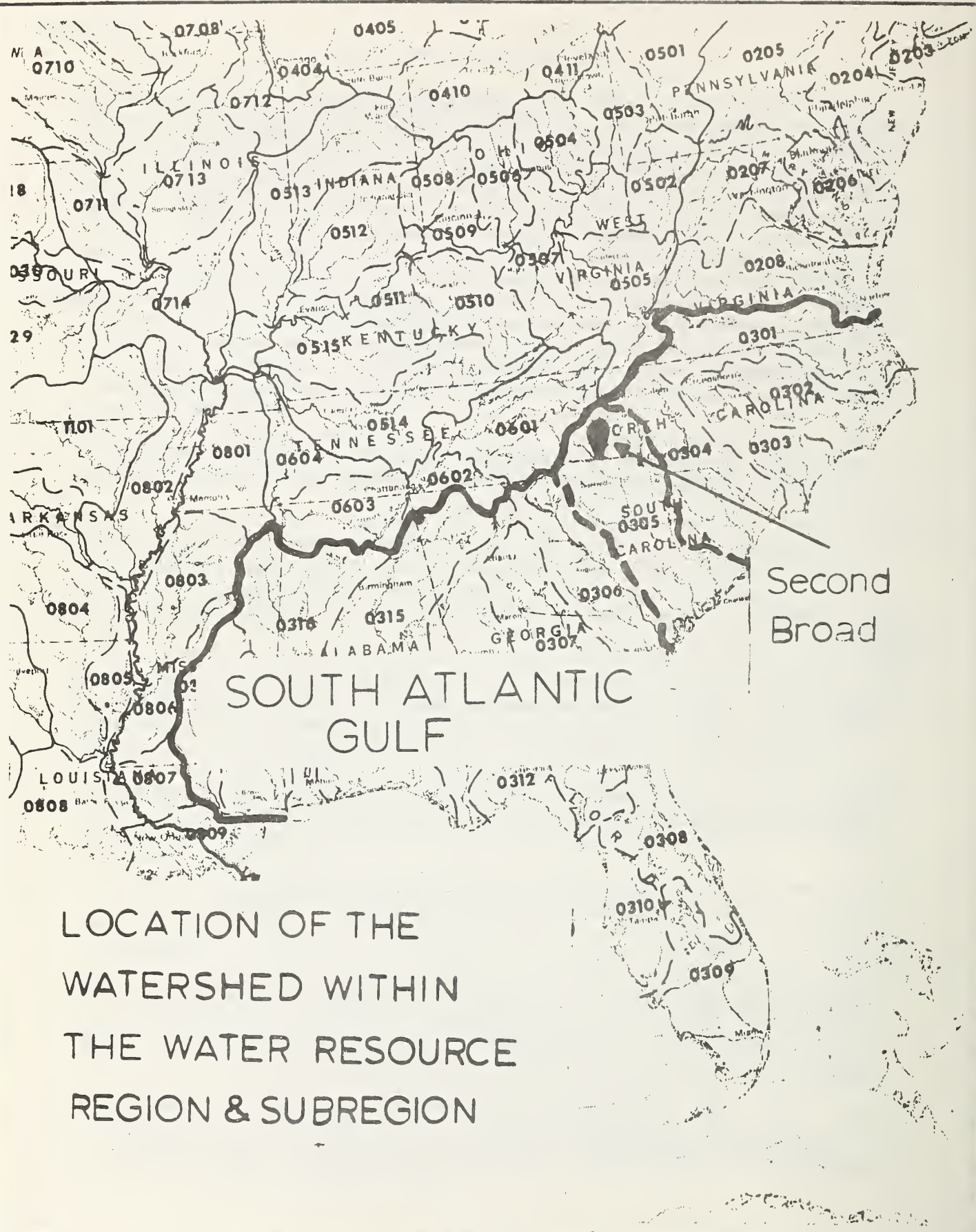


Figure 1

Principal land uses in the watershed are as follows:

<u>Land Use</u>	<u>Acres</u>	<u>Percent of Watershed</u>
Cropland	17,263	12
Hayland and pastureland	14,691	10
Forestland	94,693	66
Idle land	8,097	5.5
Miscellaneous land (roads, urban, etc.)	9,556	6.5

The cropland in the watershed also has been broken down into land capability groups (7) which show in a general way the suitability of soils for particular uses. The groups are classified according to the limitations of the soils for particular uses, the risk of damages or losses involved in their use and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with capability classification can use it to infer much about the potential behavior of soils, but this classification is not a substitute for interpretations designed to show suitability and limitations of soils for range, for forest trees, or engineering.

In the capability system, all kinds of soils are grouped at three levels: the capability class, subclass, and unit; and these are discussed in the following paragraphs:

Capability Classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode, but have other limitations, impractical to remove, that limit their use largely to pasture, range, forestland, or wildlife.

Resources

Class VI soils have severe limitations that make them generally unsuited to cultivation and that limit their use largely to pasture, range, forestland, or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture, range, forestland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and that restrict their use to recreation, wildlife, water supply, or to esthetic purposes.

Capability Subclasses are soil groups within one class; they are designated by adding a small letter, e, w, s, or c, to the class numeral; for example, IIe. The letter e shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; w shows that water in or on the soil interferes with plant growth or cultivation (in some soils, the wetness can be partly corrected by artificial drainage); s shows that the soil is limited mainly because it is shallow, droughty, or stony; and c, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In Class I, for example, there are no subclasses, because the soils of this class have few limitations. Furthermore, Class V can contain, at the most, only the subclasses indicated by w, s, and c, because the soils in Class V are subject to little or no erosion though they have other limitations that restrict their use largely to pasture, range, forestland, wildlife, or recreation.

Capability Units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol; for example, IIe-2. Thus, in one symbol the Roman numeral designates the capability class or degree of limitation, as defined in the foregoing paragraph, and the Arabic numeral specifically identifies the capability unit within each subclass. The capability unit is often omitted if all the soils of a certain class and subclass (i.e., IIe) fall in the same capability unit. So, although cropland in the watershed has been broken down into capability class and subclass, capability units have not been included because of this reason stated above.

The acres of cropland by capability group are as follows:

<u>Capability Group</u>	<u>Acres</u>	<u>Percent of Total Cropland</u>
IIe	3,966	23
IIIe	8,063	47
IVe	3,129	18
VIe	1,343	8
IIw	524	3
IIIw	238	1

As can be seen by these classifications, much of the cropland in the watershed has fairly severe erosion and water management problems, and there is great need for the conservation practices included in the project.

A further examination of the soils in the watershed reveals that they are generally acidic and low to moderate in inherent fertility (12) and are derived principally from the underlying gneiss and schist. Principal soils are in the Cecil, Hiwassee, Madison, and Wilkes series in the piedmont and in the Hayesville and Chester series in the mountains. The dominant flood plain soils are Congaree and Chewacla.

Well-drained soils on nearly level to steep topography of the piedmont, Cecil soils (9) typically have a sandy loam surface layer about seven inches thick. The subsoil is red, firm clay which extends from 40 to 60 inches below the surface, and common crops grown on this soil include small grains, corn, cotton, and tobacco.

Another soil group, the Hiwassee (9), is comprised of well-drained soils on gently sloping to steep topography of the piedmont uplands and high terraces. Typically, these soils have a dark reddish-brown surface layer and a dark red, firm clay subsoil which extends 40 to 60 inches below the surface. Principal crops grown on cleared areas of this soil are corn, small grain, hay and pasture grasses. Various species of oak, with some hickory, elm, and pine, grow on uncultivated areas. This soil does not have a flood hazard problem, but erosion problems are common.

The Madison soils (9) are well-drained soils on nearly level to steep topography of the piedmont uplands. Typically, these soils have brown gravelly fine sandy loam surfaces and yellowish-red to micaceous clay to clay loam subsoils. The cultivated soils are used principally for cotton, corn, soybeans, wheat, oats, peaches, apples, and vegetables. Shortleaf and loblolly pine are common in abandoned fields. Erosion is the main conservation problem.

Limited in use because of their shallow depth to rock, Wilkes soils (9) are well-drained shallow soils on gently sloping to steep piedmont topography. These soils have a grayish-brown sandy loam surface layer and a thin, firm clay subsoil. A high percentage of the soils is in trees and pasture.

Resources

Still another series found are the Hayesville soils (9), well-drained soils occurring on gently sloping to moderately steep inter-mountain plateaus and valleys. They have brown loam surface layers and red clay subsoils. The forested areas of these soils are generally in native forest of various oaks, hickory, maple, yellow poplar, and various other trees. Cleared areas are used for pasture, corn, small grain, hay, some fruit trees, burley tobacco, and vegetable crops.

The Chester series (9) consists of well-drained, gently sloping to moderately steep soils on low rolling hills in inter-mountain valleys. Typically, these soils have a dark yellowish-brown or brown loam surface layer about eight inches thick. The subsoil is yellowish-red clay loam about 30 inches thick. Principal crops are orchards, pasture, and general farm crops, and native vegetation is mixed hardwoods dominated by oaks.

Congaree soils (9), one of the main flood plain soils, consist of well-drained, moderately permeable, bottomland soils. They have dark brown loamy surface layers and dark brown loamy subsurface layers that are stratified. Normally located on flood plains, they are also subject to a frequent flood hazard. Most areas have been cleared and are used primarily for corn, small grain, vegetables, pasture, and hay. Native vegetation consists of oaks, hickory, gum, poplar, and loblolly pine.

Chewacla soils (9), another of the main flood plain soils, occur on nearly level, somewhat poorly drained alluvial soils on flood plains. Typically, these soils have a brown loam surface layer and a yellowish-brown silt loam to silty clay loam subsoil that is mottled with gray within 24 inches of the soil surface.

Another facet of the watershed setting involves mineral resources, and recent development of these resources in the watershed has been limited to sand, gravel, and clay. Some deposits of graphite and sillimanite have been located in the watershed. During and immediately after World War II, however, monazite (thorium ore) was produced in commercial quantities from placer deposits, and a very small amount of gold was mined during the same period.

A directory of principal mineral producers of North Carolina published by the N. C. Division of Mineral Resources lists Miller Creek quarry as being a source of crushed rock. Information Circular 16, "Mineral Localities of North Carolina", N. C. Division of Mineral Resources, 1958, lists several areas of known mineral locations of interest to mineral and rock collectors. Minerals listed include garnet, milky quartz crystals, fuchsite, corundum, and diamond.

The watershed area is underlain by an assemblage of metamorphic rock types (8). The eastern part is underlain by mica and granite schist. Hornblende gneiss, interlain with some granite, underlies the western part.

If we examine water resources in the watershed, we see that available data (8) indicate that a moderate amount of ground water can be obtained almost anywhere in the watershed area. Yields of individual wells in the area range from zero to about 45 gallons per minute, with the average being about four to eight gallons per minute (8). The yield and depth of wells in metamorphic or crystalline rock may vary greatly from area to area, as well as from well to well within a particular area (8). The available data indicate wells drilled in gneiss have slightly higher yields than wells drilled in schist (8).

Most of the towns and industries within the watershed obtain their water supply from such wells (10) although there are some towns and industries that depend on watershed streams. The towns of Forest City and Cliffside, for example, obtain their water from the Second Broad River. Several large textile industries also obtain their water supply directly from Second Broad, while Rutherfordton and Spindale receive water from Duke Power Company, which uses water from Catheys Creek and Holland Creek.

Second Broad River, another principal water resource, originates in the southern part of McDowell County and flows in a southeasterly direction through Rutherford County. (See project map.) It empties into the Broad River near the Rutherford-Cleveland County line. Principal tributary streams on the northeast side of Second Broad River are Camp Creek, Little Camp Creek, Cane Creek, and Robinson Creek. Catheys Creek is the main tributary entering from the southwest side of the river. The stream pattern of the watershed is primarily dendritic; that is, each stream or tributary branches out into smaller tributaries.

The main stem of Second Broad River and its major tributaries are permanently flowing streams with an average annual runoff of about 19.6 inches (11).

Surface water records for Second Broad River at Cliffside (11) show that the largest flow in the river for the period of record has been 15,000 cubic feet per second. The minimum flow at this same location has been four cubic feet per second. The drainage area at this gauge comprises about 94 percent of the total watershed drainage area.

There are no major reservoirs in the watershed. On Second Broad River, however, there are three minor dams owned by textile companies and used for power generation. Duke Power Company also has a small dam on Catheys Creek. In addition, there are about 115 farm ponds of two acres or less in the watershed which are in private ownership and used for fishing, livestock water supply, etc.

The streams of the watershed have been classified in accordance with the system used by the Office of Water and Air Resources of the N. C. Department of Natural and Economic Resources (12). The classification of Second Broad River, Camp Creek, Cane Creek, Robinson Creek, Little Camp Creek, and the upper portion of Catheys Creek and Holland Creek is "AII"; Catheys Creek from the Duke Power Company dam is classified "C" to its junction with Second Broad River (13). Holland Creek is classified "C" from Duke Power Company raw water intake to Catheys Creek (13). Most of the other minor streams in the watershed are classified "AII" with the exception of a few "C" streams (13).

Resources

The "AII" classification designates the water as suitable for water supply, culinary, or food processing purposes after approved treatment equal to coagulation, sedimentation, filtration, and disinfection, etc., and for any other usage requiring water of lower quality. The "C" classification designates water as suitable for fishing and fish propagation and any other usage requiring water of lower quality.

Reporting on the general water quality of a number of North Carolina streams, including the Second Broad River, Slack and Wilder of the United States Geological Survey show this river to have an average hardness concentration of 11 to 30 milligrams per liter (expressed as CaCO_3), a concentration generally considered to represent "soft" water. Average chlorides concentrations fall in the range of 0.0 to 2.9 milligrams per liter from the headwaters of the river to its junction with Cane Creek, and 3.0 to 5.9 milligrams per liter from that point to the confluence with Broad River. The average nitrate concentration in Second Broad is 0.0 to 0.5 milligrams per liter from the headwaters to the junction of Cane Creek, and 1.0 to 1.9 milligrams per liter from that point to the confluence with Broad River. The water quality information shows that the average natural color in the streams of the watershed ranges from 0 to 10 units. This color is that which comes from decomposition of organic matter and industrial pollution. It does not include any color associated with sediment. Natural color becomes detectable to the human eye at about five units; while weak tea, for example, has a color equivalent of 300 units. Other water quality information published by the U. S. Geological Survey (15) shows that the pH value of Second Broad River ranges from lows of 5.8 to highs of around 10, with the pH normally falling between 6.3 to 6.8. The dissolved solids concentration of the river ranges from a recorded low of 36 milligrams per liter to a recorded maximum of 77 milligrams per liter (16). Specific conductance has ranged from the recorded minimum of 26 micromhos to a maximum of 137 micromhos (16). This information also reveals that water temperature records for Second Broad River (16) indicate a maximum of around 80 degrees Fahrenheit and a minimum at the freezing point. Wintertime water temperatures average 45 to 55 degrees Fahrenheit (17); while summertime temperatures average 70 to 75 degrees Fahrenheit (17). The average annual sediment delivered to the mouth of the river has been estimated by the Soil Conservation Service to be 38,750 tons (119 mg/l).

Forest Resources

The major feature of the plant community in this watershed is the forestland segment. Approximately 66 percent (94,693 acres) of the land in the watershed is forested with 42 percent pine; some 5 percent pine-hardwood; 29 percent hardwood-pine; and 24 percent hardwood. Although principal species are Virginia pine, shortleaf pine, black cherry, various oaks (scarlet, chestnut, post, red, and white), yellow poplar, maple, cedar, hickory, and white pine, minor species such as black walnut, sourwood, dogwood, hornbeam, and beech are also present. The forested areas most often are dominated by a mixture

of Virginia or shortleaf pine, yellow poplar, red maple, and various oaks. Where the bottomlands have been cleared, the streams are usually bordered by a narrow margin of hardwoods, primarily yellow poplar, sycamore, willow, river birch, and alders, with an occasional mast tree. Areas of loblolly pine plantations are scattered over the watershed.

There are no Type 1 or Type 7 wetlands in the watershed as defined by the U. S. Fish and Wildlife Service (18).

Economic Data

Practically all land in the watershed is in private ownership. There are no lands administered by the U. S. Forest Service. Industrial companies own and manage about 6,800 acres of forestland. The remaining forestland is in small, privately owned tracts.

Major farm enterprises in the watershed are corn, soybeans, small grains, beef cattle, poultry production, and dairying. Corn is the major crop grown in the flood plain. Current estimated annual per acre yields for crops grown in the flood plain are as follows:

Corn	75 bushels
Corn Silage	15 tons
Soybeans	30 bushels
Wheat	45 bushels
Pasture	4 AUM

The value of the average farm, according to the 1969 Census of Agriculture, was about \$22,830 including buildings, land, and other improvements. The average value of upland is \$200-\$300 per acre, while flood plain land goes for around \$450-\$600 per acre, and urban land values range from \$1,000 to \$5,000 per acre. Some of the larger farms, especially livestock and dairy farms, have capital investments well in excess of \$100,000.

The watershed is served by an adequate network of highways, primary roads, secondary roads, and railroads. U. S. Highways 64, 74, 22, and 221-A, pass through the watershed. They provide good routes, connecting the watershed to major metropolitan and industrial areas in the mountain and piedmont sections of North and South Carolina. Accessibility of farms to this system of roads is generally fair, except during periods of high water, which may block or close some private and public roads and bridges.

The total watershed population is about 25,000 persons, with about 9,225 rural residents and 15,775 urban residents (1). Population increased by about five percent during the past decade. The general trend in the watershed, as well as Rutherford County, has been toward increased town and decreased rural population.

Resources

In the watershed, population has declined in the upstream rural areas, as shown in the following table:

	<u>1950</u>	<u>1960</u>	<u>1970</u>
Camp Creek Township - Rutherford County	1,329	1,199	1,084
Gilkey Township - Rutherford County	1,142	896	746
Brackett Township - McDowell County	200	166	135

The economy of the watershed is characterized by a strong dependence on manufacturing, non-manufacturing, and other non-agricultural employment. Work force estimates prepared by the Employment Security Commission of North Carolina (19), show that Rutherford County had a 1970 civilian work force of 19,130 employed by the various groups shown below:

Manufacturing (mainly textiles, furniture, etc.)	9,400
Non-manufacturing (construction, trade, government, etc.)	5,980
Agriculture	840
Other non-agricultural employment	<u>2,170</u>
Total employed	18,390

About 740 persons were unemployed for a rate of 3.9 percent compared to the 3.1 percent unemployment rate of 1969, and to the 6.4 percent rate of 1962 (19).

In 1970 per capita income was \$2,931 for Rutherford County compared to \$3,208 for the state (20) as a whole. The median family income in the county was \$6,646 (20). Many of the less affluent families are located on low-income family farms and it appears that underemployment is a more critical problem than is unemployment. Most people are employed, but many are working in jobs that do not produce an adequate family income.

A U. S. Department of Commerce report showed that the number of farms in Rutherford County in 1969 was 883 (21), including part-time and retirement farms. Farms average about 110 acres in size and the value of the average farm is about \$22,830, including buildings, land, and other improvements.

Nearly all farms in the watershed are owner operated. The percentage of farm tenancy in Rutherford County has steadily decreased over the past 20 years. Twenty-six percent of all farms were tenant-operated in 1950, but only three percent were tenant-operated in 1969.

Resources

Farm income was low for almost all types of farming operations in the watershed. About 80 percent of the farms in the county had sales of less than \$2,500 in 1969 (21). Of this 80 percent, there were 121 farms with full-time operators, all of which are low-income producing family farms. The census (21) lists the number of commercial farms in the county in 1969 as 189. The commercial farm is defined as having more than \$2,500 annual sales. However, 69 (37 percent) of the commercial farms had sales of less than \$5,000 per year. There are also approximately 2,400 land management units in the county in addition to those classified as farms in the census. An operating unit is defined by the National Handbook for Resource Conservation Planning (22) as all land operated as a single management unit, regardless of the number, size, or contiguity of tracts involved. Units, for example, are operated as farms, ranches, gamelands and hunting preserves, or tree farms.

The value of all farm products sold in Rutherford County in 1969 was \$3,252,392 (21) and livestock sales accounted for \$2,554,201 (78.5 percent) (21). The value of livestock products sold in 1950 was \$751,747 or 55 percent of the value of farm products sold (23). This increased importance of livestock sales in Rutherford County is typical of the watershed as a whole.

In 1969 sales of forestry products from farms in Rutherford County amounted to \$34,418 (21).

The fourth Forest Survey of North Carolina's timber resource (1974) shows the following statistics for Rutherford County:

<u>Item</u>	<u>Units</u>	<u>Softwood</u>	<u>Hardwood</u>	<u>Total</u>
-----millions of units-----				
Growing Stock	(cubic feet)	135.0	163.4	298.4
Sawtimber volume	(board feet)	301.2	403.3	704.5
Net annual growth				
a. Growing stock	(cubic feet)	7.1	9.1	16.2
b. Sawtimber				
volume	(board feet)	25.1	24.2	49.3
Net annual re-				
movals				
a. Growing stock	(cubic feet)	5.2	4.0	9.2
b. Sawtimber				
volume	(board feet)	9.9	13.1	23.1

In 1966, there were three primary wood-using industries situated in Rutherford County. This number has increased to ten by 1974. The annual value (1974) of the forest products cut from growing stock was approximately 4.8 million.

In another facet of the economic portrait, industries (mostly textile) within and near the watershed provide employment opportunities for a large portion of the watershed population. A high percentage of rural families also has one or more members employed away from the farm to supplement farm income and maintain an adequate standard of living.

The watershed is in the area covered by the Appalachian Regional Development Act of 1969. This act provides federal aid for economic redevelopment in the region covered by the act, assistance to the region in solving its particular problems, and the general utilization and development of the regions resources.

Resources

Fish and Wildlife Resources

Populations of upland wildlife species in the watershed, such as squirrel, quail, rabbit, and mourning dove, are moderate. There are low populations of deer and waterfowl in the watershed with some scattered remnants of turkey flocks. Hunting pressure for all types of wildlife in the watershed is presently low.

Wildlife habitat consists mainly of upland hardwoods and pines interspersed with agricultural lands, with the latter particularly prevalent along the streams. Wildlife, primarily squirrel, quail, rabbit, and mourning dove, also use hayland and idle land.

Varying considerably within the watershed, the fishery resource has as its main species: smallmouth bass, redbreast sunfish, carp, catfish, Dace trickle, and sucker. Various other sunfishes are present to a lesser degree. The Catalog of Inland Fisheries in North Carolina (24) lists a seven-mile section of the Second Broad River (from confluence of Little Camp Creek to the McDowell County line) with an ecological classification of smallmouth and states: "this reach supports a large population of redbreast sunfish. . . . the only substantial population of smallmouth bass found in the Broad River Watershed." Second Broad upstream from the McDowell County line is listed with an ecological classification of Dace trickle and reported to have ". . . very little gamefish habitat. . . with a large sucker population." The catalog also lists Catheys Creek, one of the major tributaries of Second Broad, with an ecological classification of sucker and reports it to be ". . . . devoid of gamefish habitat. . . with a limited sucker fishery." Most of the other streams in the watershed are narrow and shallow and provide poor fish habitat. This is also true of the streams where the impoundments are to be located. Although these smaller streams may not have a significant fishing value, they may be important to the fishery in Second Broad River and the larger tributaries. Hall (25) indicates that upstream portions of piedmont streams are quite valuable as spawning areas; these are areas of higher productivity (per unit area) than the downstream areas. Hall also found that many fishes in piedmont streams have distinct patterns of movement, with larger fish migrating upstream and smaller fish moving downstream, particularly in the spring (during the primary spawning season).

Public access to fishery resources within the watershed is limited to the two commercially operated lakes in the watershed (see recreational resources), farm ponds, and along the streams where individual landowners give permission to fish.

Sediment and sediment associated pollutants are the major problems facing fishery resources within the watershed; while a lack of management is the major problem of the wildlife resources.

Neither the U. S. Bureau of Sports Fisheries and Wildlife nor the N. C. Department of Natural and Economic Resources lists any rare or endangered species for this watershed.

Recreational Resources

In the watershed the most intensively used recreation resources are located in the urban corridor along U. S. Highway 74 in the central part of Rutherford County. (See project map). This corridor lies along the western boundary of the watershed approximately half actually being in the watershed. Composed of the adjacent municipalities of Ruth, Rutherfordton, Spindale, Forest City, and Alexander Mills, this area in 1970 had a population of 15,620, one-third of the total 47,337 population of Rutherford County (1).

According to the N. C. Department of Local Affairs (26), the following public facilities are operated by municipal governments in the watershed area:

<u>Town</u>	<u>Facility</u>	<u>Acres</u>	<u>Activities</u>
Forest City	City Park	658	Picnicking, tennis, golf, baseball, and swimming
Rutherfordton	City Park	650	Picnicking, tennis, golf, and swimming
Rutherfordton	City Pool	140	Picnicking, tennis, outdoor sports, and swimming
Rutherfordton	City Golf Course	800	Regulation golf (nine holes)
Spindale	Spindale House	--	Indoor activities, games, basketball, bowling alley, and meeting rooms
Spindale	Spindale Swimming Pool	5	Swimming

Annual attendance at some of these facilities has been estimated by the N. C. Department of Natural and Economic Resources (27) as follows:

Forest City Park (Callison Recreation Center)	47,500
Rutherfordton City Park (Crestview Park area)	25,350
Rutherfordton Municipal Pool and Park	3,700
Spindale House	5,000

Private recreational facilities in the watershed include:

- A. Camp Golden Valley, owned by the Pioneer Girl Scout Council near Sunshine. Camping is the major activity and annual attendance is estimated at 4,000.

Resources

- B. Camp McCall, owned by Western North Carolina Methodist Conference, near Bostic. Swimming is the major activity at this site, which has sleeping facilities for 20 persons. Overnight and weekend use accounts for 35 percent of the annual attendance of 7,000.
- C. Dogwood Valley Golf Course at Caroleen. Annual attendance at this club is estimated at 10,000.
- D. Rutherfordton Golf Club, just outside the watershed. Annual attendance is estimated at 8,550.
- E. Cleghorn Golf and Country Club (just outside the watershed) at Rutherfordton. Annual attendance is estimated at 8,550.

Commercial recreational facilities include:

- A. Golf driving range at Spindale - annual attendance of 9,940.
- B. Harris Speedway at Forest City - annual attendance of 30,000.

In addition, there are about 115 farm ponds of two acres or less in the watershed suitable for fishing. Only two commercially operated lakes are open to the public on a fee basis. These are Morning Star Lake, a two-acre lake near Rutherfordton, and the five-acre Toms Lake near Forest City. Estimated annual attendance at these lakes is 12,500.

Although not actually located within the watershed, several large lakes are within a 50-mile radius of the proposed recreational site. Following is a list of those lakes and the estimated annual attendance where available.

Lake Hickory	420,000
Lake Rhodiss	263,000
Lake James	239,000
Lake Lure	50,000
Lake Adgar	2,000
Greenville Reservoir (South Carolina)	Not available
Rainbow Lake (South Carolina)	Not available

These lakes receive heavy pressure from large nearby metropolitan centers such as Asheville, Greenville, Spartanburg, and Charlotte. They offer fishing, boating, picnicking opportunities, etc. The type of recreational opportunities to be offered by the proposed recreational structure will be less intense and more attractive to local watershed residents rather than residents of the large metropolitan areas.

Resources

According to a report by the Rutherford Soil and Water Conservation District (28), there are 21 potential water impoundment sites of ten acres or more in the watershed including the 12 sites where structures are planned in this project. Sites which could not be utilized without incurring excessive costs or relocation of people were not counted in this appraisal. This report also evaluated the potential for 11 major types of outdoor recreation in Rutherford County, and the county was considered to have a high potential for vacation housing and camping, small and big game hunting, vacation farms and ranches and water sports if a proposed impoundment is built on Broad River. This impoundment would be a Corps of Engineers flood control structure, and its proposed location is a short distance upstream from the confluence with the Second Broad River.

Several state parks in North Carolina and South Carolina are located within 50 miles of the proposed recreation sites. These parks are subjected to high usage just as the lakes, however, as the population within a 50-mile radius of the proposed recreational site is estimated at over 1,000,000.

Archaeological and Historical Resources

The National Register of Historic Places lists two sites in Rutherford County. Trinity Lutheran Church is located in Rutherfordton which is situated on the watershed boundary. Fox Haven Plantation is located outside the watershed 1.4 miles north of the intersection of Secondary Road 1157 and N. C. Highway 108. The Register listing for McDowell County, Carson House, is located in the vicinity of Marion which is also outside the watershed.

Contact with the North Carolina Department of Art, Culture, and History, Office of Archives and History and the Research Laboratories of Anthropology at the University of North Carolina in Chapel Hill revealed no known archaeological or historical values in the watershed. A survey contracted with the Department of Art, Culture and History covering areas to be affected by construction identified six sites as needing test excavations to determine which, if any, warranted intensive excavation to preserve adequate indications of the culture that previously inhabited the region. No early historic structures were discovered within the dam areas although several very old homesteads and cemeteries were located in close proximity. The Department of Interior, Office of Archaeology and Historic Preservation has determined the six sites are eligible for nomination to the National Register.

Soil, Water, and Plant Management Status

A high percentage of the upland in Rutherford County has been cleared for cultivation. In 1929, the county produced 36,000 acres of cotton. This acreage remained high until 1949, when 26,000 acres were grown. At that time, the county had basically an agricultural economy. Time, low income, and industrial growth have brought about many changes. Much upland, formerly in row crops, has either been abandoned, converted to pasture or hay crops, or planted to trees. Pulpwood companies have acquired considerable acreage in the county for timber growing purposes. All of these changes have had considerable effects on the agricultural and economic life of the area.

Resources

Factors of production cannot presently be efficiently used in large portions of the flood plains of the watershed. Flooding damages cause late plantings, partial harvests, excessive erosion damages repair, sediment damages to crops and increased cultivation to control weeds brought in by floodwaters. Due to flooding of the bottoms, some extremely steep, erosion-prone land is being used for crops when it is not suitable or needs some intense conservation practices to justify its use for crops.

Presently, 480 of the 1,665 operating units in the watershed have conservation plans covering 43,025 acres. These plans cover about 29 percent of the operating units, and about 30 percent of the cropland.

Adequate conservation treatment has been applied to 4,680 acres of cropland in the watershed. This includes 3,730 of the 16,501 acres of cropland subject to erosion. Of the 14,691 acres of pastureland and hayland, 4,200 acres are now adequately treated.

All of the forest land is adequately protected from forest fire under the going Cooperative Forest Fire Control Program. Forest management assistance is available to landowners under the Cooperative Forest Management Program but most of the forest land is unmanaged. In some areas, pulpwood companies have obtained and planted considerable acreages of abandoned upland to trees and manage these areas for timber production.

The privately owned farm ponds are managed primarily for private recreation, irrigation, livestock watering, etc. In addition, the U. S. Geological Survey has a stream monitoring station at Cliffside at which daily discharges, flood peaks, and other hydrologic data measurements are made. Water quality measurements are also made occasionally at this station. Partial records are also kept at several other locations within the watershed. The Water Quality Division, N. C. Department of Natural and Economic Resources, is responsible for monitoring pollution sources and enforcing state water quality regulations.

WATER AND RELATED LAND RESOURCE PROBLEMS

Land Treatment Problems

Approximately 70 percent of the cropland in the watershed needs additional conservation practices in order to be adequately treated. Among the more critically needed practices are: conservation cropping systems, crop residue use, contour farming, grassed waterways, stripcropping, terracing, and minimum tillage. Some of the steeper areas being used for row crops need to be converted to permanent vegetation such as grass or trees. Shifting of row crops from this steep land to the level, more productive flood plain would make more effective use of factors of production (land, labor, and capital investment). At present, possible losses due to flooding prevent this land use shift. The hydrologic conditions of crop and pasture land vary from fair to poor.

In addition to flooding, other land treatment problems involve owner attitudes. Small farms and small fields are sometimes difficult to get treated because the landowner does not feel treatment would be worthwhile. Absentee landowners also often balk at conservation measures because their lack of frequent contact with the land prevents an understanding of the needs. The large amount of land around this area bought and sold in speculation presents an additional problem to the conservationist for this type of landowner is interested mainly in the profit from land sales and not in preserving the productivity of the land.

Inadequate conservation treatment also is contributing to stream pollution, for rapid runoff not only transports soil particles but also carries with it other pollutants, such as animal wastes and chemicals.

The 94,693 acres of forest soils within the watershed have a hydrologic condition ranging from very good to very poor. The majority of these soils are in the poor to very poor condition which is the result of past misuse of the land. Some of the factors which caused this poor condition were, overcutting, overgrazing, and cultivation on lands now returned to forest. Much of the forestland in the poor hydrologic category is partially protected and there is still much forest land treatment needed. Again, a major problem would be in getting certain landowners interested enough to take the needed action. Logging road and skid trail damage is occurring over certain areas of the watershed where preventive measures have not been taken. Figure 15 illustrates a properly engineered and rehabilitated logging road.

Good forest soil hydrology is of great importance in the rolling and steep topography. The severity of flooding valleys below is directly related to the water-holding capacity of the forested slopes. Studies at Coweeta, N.C., and other research watersheds document the effect of good forest cover on the movement of water over and through the soil.

Floodwater Damages

Flooding of crop and pasture land is one of the main problems of agriculture in the watershed. (See Figure 3) About 40 percent of flooding occurs from April through July and most floodwater damages result from small, frequent floods. For example, the two-year, one-year, and six-month frequency storms account for about 70 percent of average annual acres inundated. However, storms of 10-year and higher frequency create conditions that contribute to frequent flooding by filling channels with sediment, by sloughing of channel banks, and washing trees and debris into channels. These conditions were noted in the lower reaches of the watershed after a storm of about a 50-year frequency occurred on August 8, 9, and 10, 1970. Damage to crops was considerably less than a similar storm occurring earlier in the growing season would have caused.

AGRICULTURAL FLOOD DAMAGES



Damage to bottom land along Second Broad River from August, 1970, Flood.



Damage to corn from floodwaters of Hollands Creek.

Resource Problems

Damage from deposition of infertile material on pastureland was severe on the common flood plain of Second Broad River and Robinson Creek. Several roads and bridges in Reach 12 were damaged (see Figure 4) and closed to traffic, and some private bridges were washed out.

Local efforts to reduce flooding, mainly clearing and snagging of channels, have been made in Reach 6 (see project map) and proved valuable during the August, 1970, storm. Flood plain land in many instances is in a less intensive land use than it would be with flood protection.

Downstream from the proposed structures, there are 4,684 acres that are flooded by the 100-year frequency storm.

Estimated average annual floodwater damages are as follows:

Crops and pasture	\$79,000
Other agricultural property (fences, farm roads, etc.)	21,000
Non-agricultural property (public roads, bridges, buildings, etc.)	<u>23,300</u>
Total	\$123,300

The following statements are quoted from the sponsors' application for assistance:

"Much of the most productive land and potentially productive land in Rutherford County lies along Second Broad River and its tributaries. Very little of this land is producing close to its potential, which is a direct result of the flooding problem.

"In years past much damage has been done by flooding. There has been flood plain scouring, pot holes washed out, sand and mud deposited and stream beds have filled. Hundreds of acres have been abandoned as a result of these conditions.

"The bottom lands are the backbone of feed production for dairy and beef cattle.

"Farmers along Second Broad River must face the fact that once or twice each year the river is going to overflow its banks. Usually, it is not a question of 'will the river get out?' but 'when?'.

"Since modern agriculture is requiring larger financial investments, the (flood) problem has become more intense for present farmers. Large amounts of cash are needed annually to meet obligations, to provide food, clothing, and other necessities of modern-day living for the farm family. Therefore, a loss due to flooding can be a significant factor in the economic life of a modern farmer.

'FLOOD DAMAGES TO ROADS AND BRIDGES



Bridge completely washed out on Highway 1745 near Sunshine in August, 1970, Flood.

"In conclusion, the people of Rutherford County are convinced that flood control, pollution control, and erosion control are basic to permanent progress. We are committed to the ideal of good living for ourselves and leaving a better land for future generations."

Erosion Damages

Total erosion in the watershed from all sources is 913,110 tons annually with sheet erosion from the 134,744 acres of agricultural land (crop, hay and pasture, idle, and forest) accounting for 640,040 tons. The average sheet erosion rate for crop, pasture, and idle land is 4.75 tons per year, and the average erosion rate for forestland is 0.40 tons per acre per year.

Erosion from 3,650 acres of roads amounts to another 124,100 tons annually. Unpaved roads account for 58,400 tons and paved roads amount to 65,700 tons annually; with the average annual erosion rate for roads being 34 tons per acre.

Gully, or critical area erosion, is 80,000 tons annually and the average annual gully erosion rate is estimated to be 186 tons per acres.

Urban and residential areas account for 68,970 tons annually with the average erosion rate being 12.6 tons per acre per year.

Streambanks in the watershed are stable, so streambank and stream channel erosion is very light. Flood plain erosion is in the form of sheet erosion and is included with the sheet erosion data stated above.

Critical sediment source areas are limited to roadbanks, dirt roads, and 430 acres of gully erosion. Gully erosion and roadbank erosion occur in small areas scattered throughout the watershed. Several thousand acres of former cropland have been damaged by past gully erosion to the extent that the land is now suitable only for forest use.

Sheet erosion has removed most of the topsoil from uplands used for crops now or in the past. Some land has reverted to grass and trees, and production potential on land remaining in cultivation has been reduced about 33 percent because of sheet erosion.

As a result of erosion, the land area devoted to crops is considerably less today than it was during the 1930's, and although the watershed population has increased, the number of man-days utilized for agriculture has decreased.

Sediment Damages

Overbank deposition has damaged 2,765 acres of crops and pasture in the flood plain. Damage to production ranges from 5 to 70 percent of the undamaged values. Although the current rate of deposition is less than that during the peak erosion period of the 1920's and 1930's, productivity of crop and pasture land is still reduced by sediment deposition. Depth of deposited material ranges from about 6 to 50 inches. The sand and loamy sand sediments have been deposited on the fine sandy loams and silt loams constituting the original undamaged flood plains.

Sediment damages also occur to downstream reservoirs on the Broad River and to industrial water supplies due to required filtering of the water before its use.

At the mouth of the watershed current sediment yield is approximately 38,750 tons or 119 milligrams per liter, with milligrams per liter (mg/l) expressing the concentration of chemical constituents in solution. It thus represents the weight of solute per unit volume of water. Turbidity also is increased by the suspended sediment load and this sediment can transport chemicals and other pollutants which lower water quality. Progressive swamping has almost ceased with the decline in up-land erosion. Furthermore, sediment can damage downstream reservoirs by lowering their capacity and can injure industrial water supplies by requiring more expensive filtering processes.

The overall average annual damage from sediment is estimated to be \$130,600.

Drainage and Irrigation Problems

Drainage and irrigation problems in the watershed have been minimal; therefore, these have never been major considerations in formulating the project. However, drainage is needed on scattered areas of wet crop and pasture land in the flood plain.

Municipal and Industrial Water Problems

The cities of Rutherfordton, Forest City, and Spindale receive their water from the streams of the watershed and their present supplies are limited. The U. S. Army, Corps of Engineers, is studying a proposed Broad River impoundment a short distance upstream from the confluence with the Second Broad River. This proposed impoundment will most logically be the future source of municipal and industrial water for the entire area of Rutherford County.

Resource Problems

Recreational Problems

According to the application for assistance, there are no convenient outdoor recreational facilities for citizens in the watershed and the need for recreation was stressed during the campaign for the countywide vote on the watershed improvement tax. The Governmental Services and Recreation Study and Plan (26), published by the N. C. Department of Local Affairs, Division of Community Planning, states: "The county should provide facilities and programs which, by nature, are county-wide and are, therefore, beyond the role of municipal governments (activities such as the development of lakes and multi-purpose large parks for boating, canoeing, camping, horseback riding, golfing, sledding, etc.)."

Except for privately owned fishing ponds, there is a general lack of water-based recreation within the watershed and surrounding area. The two commercially operated lakes provide the only public fishing. According to the N. C. Department of Natural and Economic Resources (30), the region made up of McDowell, Rutherford, Polk, and Cleveland Counties has 29.46 surface acres of water per 1,000 population (lakes of 100 plus acres), a low ratio compared to the state average of 53.09 acres/1,000 population. The region has 0.43 percent of its total surface area in lakes of 100 plus acres as compared to the state average of 0.79 percent.

Water quality of the streams where recreational development is proposed is high enough to present no problems. The present quality classification (AII), is higher than that required by law for recreation (B); the AII classification being suitable as a source of water supply for drinking, culinary or food processing, after approved treatment; and the B classification being suitable for outdoor bathing and any other usage requiring waters of lower quality. Land above these structures is mainly forested with some scattered areas of crop and pasture land. Sediment will not be a problem except after large storms when land in row crops and logging roads might produce enough sediment to temporarily muddy the reservoir waters. Agricultural pollution from pesticides, herbicides, and fertilizers can be expected to be minimal above the proposed recreational sites due to the low density of agricultural activity.

All of Polk and Rutherford Counties and most of McDowell, Burke, and Cleveland Counties lie within 30 miles of the proposed watershed recreational sites. The 1970 population and the population projected for 2020 by the Environmental Protection Agency are as follows:

<u>County</u>	<u>1970</u>	<u>2020 (Projected)</u>
Rutherford	47,337	56,500
Polk	11,735	14,500
McDowell	30,648	50,000
Burke	60,364	88,500
Cleveland	<u>72,556</u>	<u>101,500</u>
Total	222,640	311,000

The present population within 50 miles of the proposed recreational site is well over one million.

Fish and Wildlife Resource Problems

Fishery resources within the watershed are limited for its streams are often turbid, especially after rains, and provide poor fish habitat. The heavy sediment loads in these streams come primarily from eroding crop fields, sand dredging operations, and critical areas, such as bare road-banks. Sediment pollution is the major factor influencing the fishery resources.

Wildlife habitat is primarily of the upland type. Wetland habitat is generally lacking in the watershed. Turkey populations, once abundant, are now almost non-existent due to past land use patterns and severe overhunting.

Probably the greatest problem relating to wildlife resources is the lack of management practices specifically designed to benefit wildlife. Virtually no wildlife habitat management practices are in evidence. Good management for the improvement or preservation of habitat types for the upland species is needed.

The N. C. Department of Natural and Economic Resources also came to much the same conclusions in its study of the Broad River (10). Following are quotations taken from its report on that study.

"The major conclusions on the effects of pollution in the Basin were the following; in the Piedmont soil erosion is the most important factor limiting the production of game fish "

and,

"The wildlife resources of the Broad River Basin are generally only fair. There appears to have been only a little concern for wildlife management in the past, and thus game populations are far below their potential."

Economic and Social Problems

The greatest economic problem in the watershed is the large number of farms which sell less than \$2,500 worth of products annually. Well over 90 percent of the farms in Rutherford County had total sales of less than \$5,000, according to the Census of Agriculture (21). The Census also reports that 121 farms in the county with full-time operators had sales of less than \$2,500. These are the low-income producing family farms.

Resource Problems

The problems of low-income, underemployment, and poor quality public facilities have generally been associated with the depopulation of rural areas. Promotion of rural community development is needed most in the upper reaches of the watershed. This area has lost population as the number of farms has declined. Camp Creek Township population declined from 1,329 in 1950 to 1,084 in 1970, and Gilkey Township declined from 1,142 to 746 over the same period.

In the urban, downstream area population has increased--particularly in and around Forest City. However, the N. C. Office of State Planning Division (31), estimates the rate of out-migration from Rutherford County at 4.21 percent for the decade 1961-1970. This places net out-migration at approximately 2,000 persons.

PROJECTS OF OTHER AGENCIES

There are no existing or soon-to-be constructed water resource development projects (county, state, or federal) which have a direct relationship to the works of improvement included in this plan. The Corps of Engineers does have under consideration a proposed impoundment on the Broad River just upstream from the junction of Second Broad. This site would probably be developed as a municipal and industrial water supply. No definite plans have been made in regard to this structure.

PROJECT FORMULATION

An application for federal assistance under the Watershed Protection and Flood Prevention Act was filed for the Camp Creek-Cane Creek Watershed with the State Soil and Water Conservation Committee in February, 1965. The field examination of Camp Creek-Cane Creek was held February 17, 1965. Prior to the examination, a notice of, and an invitation to attend this activity was sent to all concerned federal and state agencies, and other interested parties. This was an attempt to involve all concerned agencies and persons in the project formulation from the beginning.

A report was prepared in March, 1965, containing the conclusions of the examination and was mailed to all those agencies and individuals who were originally invited to attend the examination.

The administrator of the Soil Conservation Service authorized planning assistance in July, 1966.

Interest in the Second Broad River developed to the extent that an application for federal assistance was submitted in November, 1966, and in March, 1967, the application was amended to include the Camp Creek-Cane Creek Watershed.

In February, 1968, authorization for planning the Second Broad River Watershed was granted by the administrator of the Soil Conservation Service.

During the application and planning stage, the Soil Conservation Service officials met with the Rutherford County Watershed Commission on numerous occasions.

All interested agencies and individuals were consulted during the application and planning stage. The N. C. Division of Forest Resources and the U. S. Forest Service made inputs into the work plan. The N. C. Wildlife Resources Commission and the U. S. Bureau of Sports Fisheries and Wildlife comments have been co-ordinated with the works of improvement proposed in this plan. All interested agencies, state and federal, were invited to participate in all the meetings during the application and planning stages.

The U. S. Bureau of Sports Fisheries and Wildlife suggested that:

- (1) Bottom intakes and minimum flow orifices be included in three impoundment structures to provide suitable downstream flows and water temperatures for maintenance of smallmouth bass habitat in the Second Broad River; and
- (2) a duck window be installed in each impoundment outlet structure.

Several public meetings concerning project formulation and development have been held. On November 20, 1970, about 85 interested citizens met to discuss the proposed plan. There was close co-operation between the sponsors and the Soil Conservation Service in developing the Second Broad River Watershed Work Plan.

Objectives

The goal for carrying out the land treatment program will be the adequate conservation treatment of 50 percent of all the cropland and 83 percent of all the pastureland and hayland within the watershed. Conservation plans will be developed on 65 percent of the farms in the watershed. Another land treatment objective is to increase forest cover and improve soil hydrology as well as increase income from the small private forest holdings through development of a sound forest management program.

The flood prevention objective of this project is to provide the most practical and economical degree of flood protection possible within the watershed constraints and Public Law 566 regulations.

Formulation

The objective for preservation, improvement, and development of fish and wildlife resources will be accomplished by the management of 323 acres of upland wildlife habitat; the creation and management of 19 acres of wetland wildlife habitat; and the maintenance and improvement of fish habitat through the creation of 470 acres of water in the planned structures; minimum flow orifices for low flow augmentation; and cold-water releases for holding down water temperatures. Duck windows will be installed on Structure Nos. 11, 22, and 23.

Farm ponds and streams offer the only available water-based recreation within the watershed. The present population within a 25-mile radius is 90,000 and it is anticipated that it will reach 125,000 by the year 2000. This situation has caused the sponsoring local organization to request the full development of a 185-acre lake and adjacent land for water-based recreation and another smaller lake providing capacity for recreation and development in the future. Objectives for the development were that it be designed with the following capacities: fishing - 150; boating - 50; picnicking - 725; primitive camping - 200; trailer camping - 160; and swimming - 600.

Environmental Considerations

Water quality of the streams where recreational development is proposed is high enough to present no problems. The present quality classification (AII), is higher than that required of law for recreation (B); the AII classification being suitable as a source of water supply for drinking, culinary or food processing, after approved treatment, and the B classification being suitable for outdoor bathing and any other usage requiring waters of lower quality. Land above these structures is mainly forested with some scattered pasture and cropland. Sediment will not be a problem except after large storms when this small area of land in row crops and logging roads will produce enough sediment to temporarily muddy the reservoir waters. Agricultural pollution from pesticides, herbicides, and fertilizers can be expected to be minimal above the proposed recreation sites because of the low density of agricultural activities.

There will be no induced downstream damages with the project installed. The reduction in stage in the streams in the lower portion of the watershed (below Forest City) will be very minor.

The plan, as originally formulated, involved clearing and snagging work on about 60 miles of channels in the watershed. This would have resulted in a higher level of protection than the planned project. However, due to environmental considerations involving adverse impacts of some of this work on fish and wildlife resources and the possibility of unstable channels, channel work was reconsidered and proposed clearing and snagging work was eliminated.

One particular reach of Second Broad River is considered as having a significant smallmouth bass fishery. Structure Nos. 11, 22, and 23 are upstream of this reach. Cold-water releases have been designed in each of these structures to release the cooler bottom waters of the reservoirs to help maintain the smallmouth bass habitat downstream. Additionally, duck windows will provide the opportunity of managing the structures for wildlife habitat.

Most of the planned structures in this project are on streams too small to support a significant fishery. Approximately ⁴⁷⁰ acres of fish habitat in lakes will replace the existing stream fishery where the structures are located.

It is estimated that there will be a displacement of four dwellings and 12 farm operations by the installation of the works of improvement.

Under the provisions of the Uniform Relocation Assistance and Real Properties Acquisition Act of 1970, the displaced person will be provided decent, safe, and sanitary replacement housing, as well as relocation assistance and compensation for any other damages or losses. The 12 farm operations to be displaced will also be compensated for any losses.

Alternatives

Accelerated Land Treatment Program - This alternative consists of an accelerated land treatment program on 15,795 acres of crop, pasture, and miscellaneous land and on 24,223 acres of forestland. Technical assistance for installation of this alternative would be provided by the Soil Conservation Service and the Forest Service in cooperation with the North Carolina Division of Forest Resources.

The land treatment measures in this alternative are discussed under Works of Improvement to be Installed (p. 33). Benefits derived from land treatment include a reduction in annual erosion from 913,100 tons to 639,200 tons. This sediment reduction, together with associated pollutants, would benefit the fishery resource and the municipal and industrial water users who obtain their water supplies from streams in the watershed. Less sediment would be deposited through overbank deposition. However, while helping to some degree in reducing flood damages from smaller, less intensive storms, land treatment would have little effect in reducing damages from heavy extended rainfalls. Average annual benefits from the reduction in floodwater damage and sediment are estimated to be \$35,700. Additional benefits would be attributed to upland wildlife habitat through wildlife plantings on 274 acres and more intensive management of 49 acres of existing habitat.

Formulation

Adverse environmental effects caused by the planned project, such as elimination of 10 miles of stream fishery habitat and 274 acres of wildlife habitat (forestland) and removal of 230 acres of crop and pasture land, would be avoided. Future productivity of the land on which land treatment measures are applied also would be assured.

However, favorable environmental effects of the planned project, such as 152,000 visitor-days of recreation annually, 504 acres of fishery habitat and 19 acres of managed waterfowl feeding area, will be foregone with this alternative. In addition, average annual floodwater damages amounting to \$100,000 would continue. The total installation cost of this alternative is \$2,323,180, or about \$131,250 annually.

Dikes and Pumps with Land Treatment - A system of dikes, collection ditches, and pumping plants used in conjunction with an accelerated land treatment program was considered as an alternate method of providing flood protection. Benefits from erosion and sediment reduction were estimated to be the same as with the accelerated land treatment alternative previously discussed. With a wildlife management program, the area (2,450 acres) committed to the dikes and ditches would benefit wildlife in the watershed. In addition, there would be flood protection for 2,336 acres of flood plain. Adverse effects associated with floodwater retarding structures, such as elimination of 10 miles of stream fishery habitat and family and farm displacements, would be avoided. Average annual benefits, derived principally from floodwater damage reduction, are estimated to be \$150,000.

Approximately 2,450 acres of flood plain would be committed to the dikes and collection ditches, thus creating "uneconomic remnants", and causing displacement of some farm operations. Favorable environmental effects associated with floodwater retarding structures, such as 152,000 annual visitor-days of recreation, 470 acres of fishery habitat, and 19 acres of managed waterfowl feeding area, would be foregone with this alternative. The total installation cost of diking and pumping is estimated at \$10,000,000, with an annual operation and maintenance cost of \$220,000. These costs are equivalent to an average annual cost of \$880,000.

Channel Work with Land Treatment - Channel work in combination with an accelerated land treatment program was originally considered as a possible solution to the flooding problem in the watershed. Preliminary investigations, however, revealed that channel excavation or channel clearing and snagging would increase velocities to the point that an unstable channel would result. Because of the amount of excavation and clearing and snagging needed to provide capacity for the peak of the 5-year, 24-hour frequency storm and the high cost involved in grade stabilization structures to provide a stable channel, under the criteria of Technical Release 25, all alternatives involving channel work were omitted from further consideration.

Flood Plain Purchase with Land Treatment - The purchase of flood plain land in combination with an accelerated land treatment program was considered as an alternative to structural measures in solving the flooding problem. The future use of the land purchased would be limited to those uses which would tolerate periodic flooding, such as forestland managed for multiple products, timber, recreation, wildlife and aesthetics. An abundance of picnic areas, nature areas, bike trails, etc., could be created. There would be 3,230 acres available for recreational use and timber production. This alternative would prevent an estimated \$100,000 annually in agricultural floodwater damages. In addition, adverse environmental effects associated with the planned project would be avoided.

Benefits from the land treatment program would, of course, be the same as described under the accelerated land treatment alternative on page 30. These include the overall reduction in watershed erosion from 913,100 tons to 639,200 tons, a 45,050 ton annual reduction in sediment delivered into streams along with associated improvements in water quality. Some reduction in floodwater damage, especially from the smaller, less intense storm would also be realized. Wildlife plantings and habitat management will benefit upland wildlife.

Average annual floodwater damages to public roads and bridges in the amount of \$23,300 and sediment damages of \$95,500 would continue with this alternative. The purchase of 3,230 acres of crop and pasture land is estimated to cost \$2,580,000. At least 150 farmers who own flood plain land would be affected by the purchase. An additional \$440,000 would, therefore, be required for relocation costs. The relocations would also increase the out-migration rate from the rural areas in the watershed. The average annual cost of this alternative is estimated to be \$171,000, exclusive of land treatment costs.

Other Considerations - The Federal Crop Insurance Program has been discontinued for all crops in Rutherford County and, thus, offers no solution, or compensation for the flooding problem.

At this time there are no other federal nor state programs which offer possible alternate uses of the entire flood plain land in the watershed. The recently implemented Rural Environmental Conservation Program offers some possibilities of alternate uses on an individual basis.

No Project - Leaving the watershed in its existing state would avoid the elimination of 470 acres (254 acres of forestland and 216 acres of crop and pasture) of wildlife habitat and 10 miles of stream fishery habitat. However, the steep uplands would continue to be used for production of row crops increasing erosion and sedimentation problems (see pp 23-24). Flooding problems would worsen as channels continue to be filled with sediment and debris. There would be 470 acres of fishery habitat and 19 acres of managed waterfowl feeding area and 152,000 visitor-days annually of recreation foregone with this alternative. The total estimated average annual net benefits foregone with no project would be \$135,385.

Formulation

The project was finalized after all alternatives were evaluated. Land treatment measures selected were those which would provide watershed protection, while permitting production of crops essential to the economy of the watershed. Provisions are included whereby alternate treatments may be used when the needs of a landowner can best be served by the change.

Structural measures included in the plan are those which best meet the objectives of the sponsoring local organization, are economically feasible, and have the least effect on the natural resources of the area. A minimal amount of fish and wildlife habitat will be lost. Lake fishing opportunities will be increased and upland game habitat management will be increased.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment

This phase of the watershed project involves an accelerated land treatment program on 15,795 acres of cropland, grassland, and miscellaneous land and forest land treatment measures on 24,223 acres. Technical assistance for planning and installation of land treatment measures will be provided by the Soil Conservation Service through the Rutherford and McDowell Soil and Water Conservation Districts. The Division of Forest Resources in cooperation with the U. S. Forest Service will provide the technical assistance for planning and installing all forestry measures.

The planned land treatment measures are necessary to properly conserve, develop, and improve land and to insure realization of benefits which justify structural measures. Cropland, grassland, and miscellaneous land treatment includes vegetative and mechanical measures. Vegetative measures will consist of conservation cropping systems, crop residue use, field border planting, stripcropping, minimum tillage, and pastureland and hayland planting and management. Mechanical measures will include contour farming, grassed waterways, diversions, terracing, subsurface and open drains, and land smoothing. Planned forestry measures include tree planting for critical area stabilization and watershed protection, stand improvement measures, and continuation of the present Cooperative Forest Fire Control Program.

Land treatment on both cropland and forestland may involve a combination of several practices to obtain an adequate level of treatment. Therefore, a particular acre may be included more than once in the following description of individual practices, and the summation of acres to be treated by individual practices will exceed the actual acres to be treated. Land adequately treated is defined as land used within its capability on which the conservation practices that are essential to its protection and planned improvement have been applied.

Approximately 430 acres of critically eroding areas will be treated. (See Figure 4). Of these 430 acres, 273 will be planted to trees and 157 will be planted in grasses and legumes. Some of the critical areas (82 acres) are located above the planned reservoirs. The sponsors are responsible for treating 75 percent (62 acres) of the critical areas before the advertisement of bids for construction of the reservoirs.

The planned project includes the use of conservation cropping systems on 2,026 acres. Conservation cropping systems are used to protect the soil against erosion, maintain its fertility, and to aid in the control of insects and diseases.

Cover crops are planned for use on 1,109 acres. The cover crop protects the soil from erosion, adds organic matter, and generally improves the soil tilth.

Grasses and legumes in rotation are planned on 427 acres as part of conservation cropping systems. They are established for a definite number of years to produce forage, reduce soil and water loss, supply organic matter, and improve soil productivity. Crop residue use will be initiated on 1,423 acres also for the purpose of adding organic matter and improving growing conditions in the soil. (See Figure 5).

Minimum tillage incorporates the use of chemical and limited cultural operations to keep the disturbance of the soil to a minimum. (See Figure 6). This measure will be used on 1,049 acres.

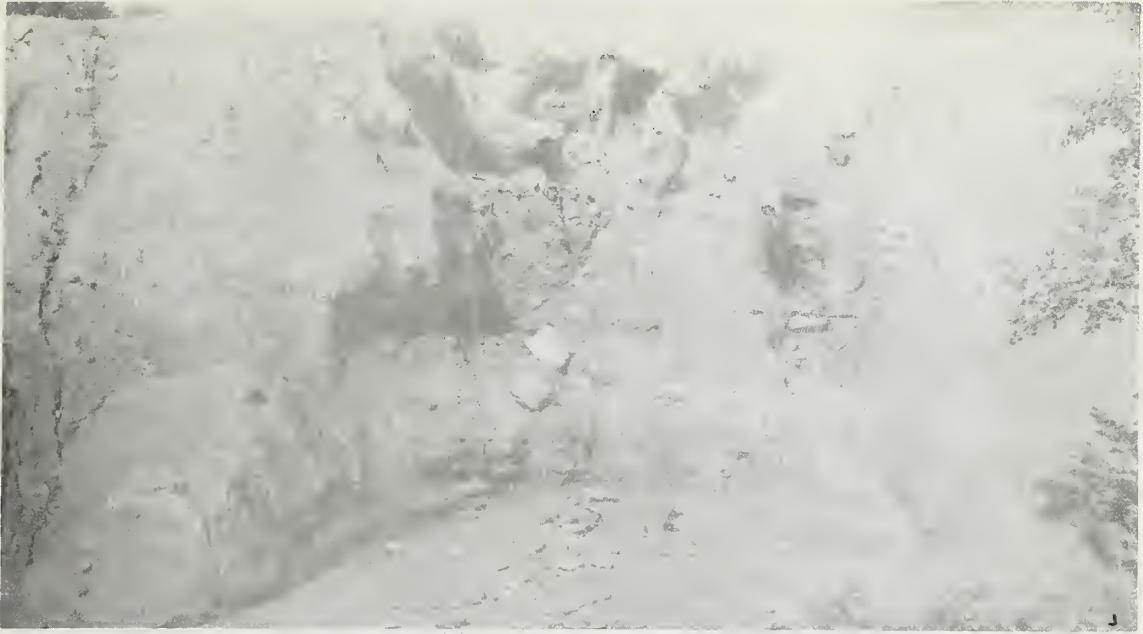
A total of 27,900 linear feet of field border planting is planned for the watershed. The field border is a strip of perennial vegetation established at the edge of a field to prevent erosion, reduce competition from adjacent forestland, provide wildlife food and cover, and improve the appearance of the field. (See Figure 7).

Stripcropping is another practice used to reduce soil erosion and control water. It will be used on 262 acres as part of the land treatment program. (See Figure 8).

There are 1,884 acres of pastureland and hayland in the watershed that are scheduled to be brought under an improved management program. New pastureland and hayland will be established on 7,300 acres (See Figure 9). The main areas where the new pastureland and hayland will be established are presently areas of idle land or areas which are presently being used for crops where the land is not suitable for crops. This will represent a significant conversion of land to a more desirable and suitable use.

One of the most beneficial mechanical conservation practices to be applied to the sloping cropland is contour farming. (See Figure 10) Contour farming will be used on 1,749 acres of sloping cropland in the watershed.

- CRITICAL SEDIMENT AREAS



Severe erosion and sediment resulted when a new shopping center area was graded in 1969 and left with no protective vegetation. This is near Spindale in Rutherford County.



This abandoned dirt road has been ravaged by erosion, causing heavy siltation. This area will be planted to trees. It is near Camp Creek in Rutherford County.

Figure 4

CROP RESIDUE USE



After this corn is harvested, pulverized stalks and other residue will remain to protect the soil through the winter. Plowed under in the spring, the residue will provide organic nutrients to the soil. This field is near Sunshine in Rutherford County.



A corn crop was produced on this field near Gilkey, in Rutherford County, by minimum tillage cultivation. Fescue, which acted as a mulch between rows, is still visible.

Figure 5

MINIMUM TILLAGE



This corn near Lamb's Store (Rutherford County) is planted in rye residue by minimum tillage. Residue gives a protective covering to the ground.



This is a minimum tillage planting, with a row crop being planted in grass. Note the chemical spray behind the planter. In a single operation, seed is planted, fertilizer applied, and chemicals added. This is near Old Springs Church in Rutherford County.

Figure 6

FIELD BORDERS



Fescue has been planted along the edge of this road near Oakland, in Rutherford County, to constitute a field border to the field at right, which is planted in small grain.



A wide grassy strip forms a field border. This wide area provides turning room for farm equipment and also prevents erosion.

STRIPCROPPING



Stripcropping on this field in Rutherford County has alternate bands of alfalfa and corn; the corn has just started to emerge in rows at center.



Here stripcropping--planting alternate "strips" of different crops --has small grain planted between grass strips. Location - Rutherford County.



Holstein cattle graze on excellent fescue pasture near Rutherfordton. Good management really paid off here!



Although seeded less than a year, this three-acre field of alfalfa in Rutherford County has already produced 165 bales of hay, and four to five tons a year per acre is expected. Hayland planting is an important part of this watershed project.

-CONTOUR FARMING



This Rutherford County apple orchard is planted on land contours. Notice the well-established fescue between the apple trees.



Planting row crops on the contour is one of the most effective methods of combating soil erosion on sloping cropland. This field is in Mecklenburg County.

Figure 10

A second mechanical measure planned involves terracing, oftentimes needed in conjunction with contour farming to intercept runoff water and remove it at a non-erosive velocity. (See Figure 11) The goal for this project is installation of 349,800 linear feet of terrace systems on the sloping cropland.

The diversion (See Figure 12) is very similar to a terrace except its location and purpose are different. Its purpose is to divert undesirable or excess water from one area to another where it can be used or disposed of safely. Approximately 52,420 linear feet of diversion will be built.

Another land treatment practice involves the use of grassed waterways (See Figure 13) as outlets for terrace systems or other places where runoff tends to accumulate. A total of 46 acres of waterways will be installed.

Approximately 29,415 linear feet of subsurface drains, 8,880 linear feet of drainage mains and laterals, and 2,220 linear feet of field ditches will be installed. The subsurface drains and some of the open drains will serve to lower the water table on areas having drainage problems. (See Figure 14)

Land smoothing which will be done on 282 acres involves the removal of surface irregularities such as depressions, mounds, old terraces, and turn rows by use of special equipment. This practice is used to improve surface drainage, provide for more effective use of precipitation and to facilitate cultivation.

A total of 342 acres will be managed as wildlife habitat. This includes wildlife plantings (food and cover plants) on 274 acres, improvement and a higher level of management on 49 acres of existing habitat, and management of 19 acres of wetland habitat in three of the floodwater retarding structures.

It is estimated that 1,480 acres of cropland, and 1,265 acres of pastureland and hayland will receive partial treatment. This will be in addition to the acres of crop and pasture land described previously which will receive adequate treatment. Partially treated land has had one or more conservation measures applied on it, but it still needs other measures to be fully and adequately treated.

It is estimated that approximately 44,000 acres of soil mapping will be needed during the project installation period to successfully carry out the planned measures. About 60 percent of this mapping will be accomplished as part of the accelerated technical assistance and 40 percent will be done under the present soil and water conservation district program.

The forestry phase of the land treatment program involves a forest management program including tree planting on 273 acres of critically eroding land as mentioned previously, 8,180 acres of tree planting (see Figure 16) for watershed

TERRACES



This grader is constructing a terrace in Rutherford County, leaving a ridge and channel at left to convey water. Apple trees will be planted along the ridge of the terrace.



Terraces work well on this steeply sloping field in Yadkin County to intercept water and carry it safely off the field. Notice channels between the ridges.

DIVERSIONS



This diversion between the forestland and cultivated field at right protects the 14 acres of Rutherford County bottom land from water which runs from higher ground behind the forested area.



This diversion, at left center in photo, routes water around the cultivated field at right.

Figure 12

• GRASSED WATERWAYS

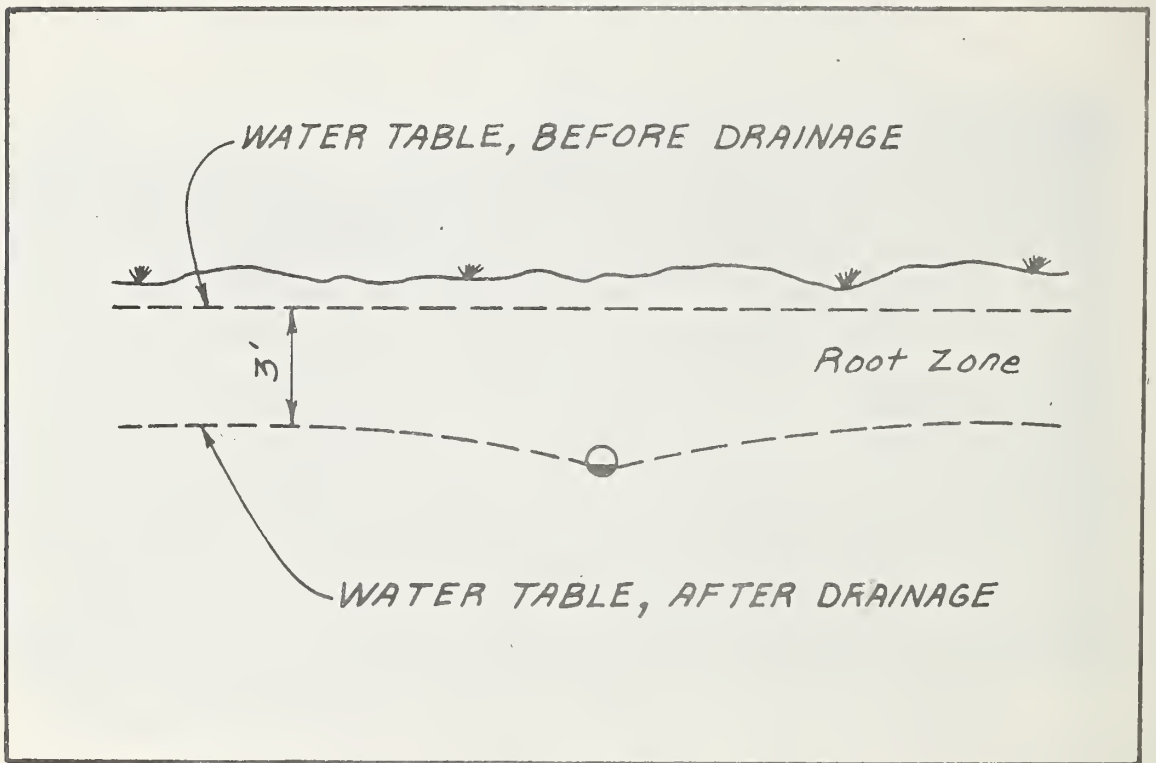
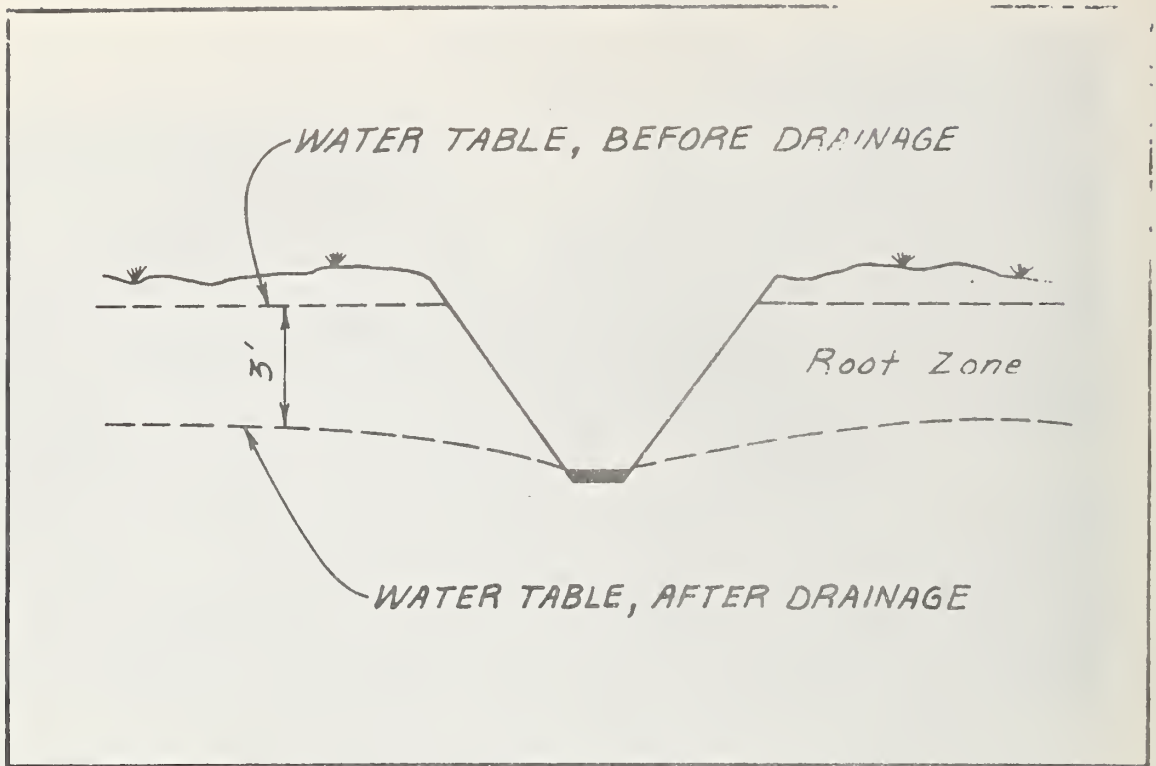


This grassed waterway safely disposes of surplus water in this Rutherford County apple orchard.



This grassed waterway between two planted areas of soybeans does a good job in carrying water from contoured crops.

Figure 13



TILE AND OPEN DRAINS

Figure 14



Seeded Logging Roads Help Control Erosion

A properly engineered and maintained forest road system provides permanent access with minimum damage to other forest resource values. This road was seeded to grass after forest improvement measures were completed. It now provides food and open space habitat for wildlife, serves as a trail for hikers and hunters, provides access for forest fire protection.

-(U. S. Forest Service Photo)

Figure 15



A Properly Thinned Pine Forest

Periodic thinning during the life of a pine or hardwood forest is necessary to provide adequate growing space, assure optimum increment and maintain healthy growing conditions.

(N. C. Division of Forestry Photo)

Figure 16

protection, and stand improvement measures on 15,770 acres of forestland. Of these 15,770 acres, 12,370 acres are in private ownership and 3,400 acres are in industrial ownership. The tree planting will serve the purpose of controlling erosion, reinforcing understocked stands and replacement of less desirable species and improving the natural beauty and aesthetic value of the treated forestland (See Figures 15 and 16). The continued increase in efficiency and effectiveness of fire control activities through the going Cooperative Forest Fire Control Program will control any increased fire hazards that result from the project.

The forest management program is aimed at meeting watershed needs and objectives. The forestlands will be managed to fulfill timber, wildlife, and recreation needs to the extent that such management is compatible with the overall watershed management. Hardwoods will be maintained on suitable hardwood sites and pine-hardwood mixtures will be encouraged on pinelands. A balance will be maintained between food-bearing, den, and potential timber trees. Any problems arising from urban development taking place in the forested part of the watershed will be alleviated through the co-ordinated effort of the watershed forester and planning commissions, land developers, or the particular organization involved.

The North Carolina Division of Forest Resources, with guidance from the North Carolina Wildlife Resources Commission, will provide technical assistance to forestland owners in the planning and application of forestland wildlife habitat improvement practices.

It is estimated that conservation plans will be developed for an additional 394 units during the project installation period and that 376 additional land-owners will enter into co-operative agreements with soil and water conservation districts for assistance in installing land treatment measures. These plans will cover forest areas as well as cropland and pastureland.

Structural Measures

Proposed structural works of improvement consist of two multiple-purpose structures (one with a complete recreational development and one with water resource improvement for recreation) and ten single-purpose floodwater retarding structures.

The single-purpose floodwater retarding structure is a structure designed to provide for temporary floodwater storage and for its controlled release. (See Figure 17) The only additional storage in this structure is that provided for sediment anticipated to accumulate in the structure over its designed life. (See Figure 18) A multiple-purpose structure has storage capacity for one or more beneficial uses (e.g. recreation) in addition to its floodwater and sediment storage (See Figure 19). The multiple-purpose structures in this project are designed as Numbers 2 and 3A. (See project map) All proposed structures are designed for a 100-year life and will thus have 100-year sediment storage. However, 297 acre-feet of storage capacity allotted to sediment in the 12 structures will initially be available for floodwater storage.

FLOODWATER RETARDING STRUCTURES

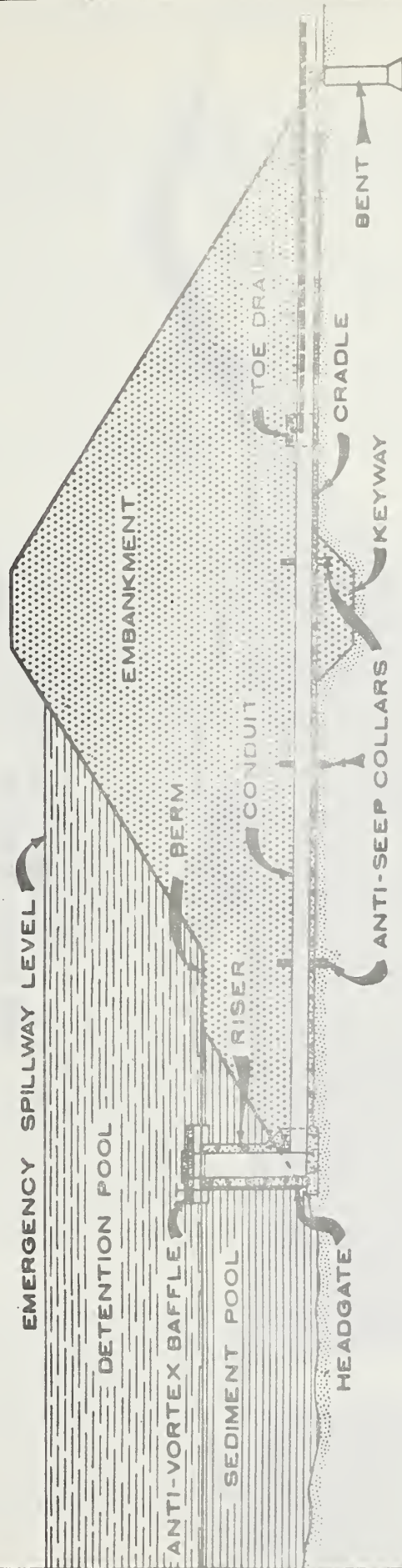


A recently constructed floodwater retarding structure on Stewarts Creek-Loville Creek Watershed Project in North Carolina.



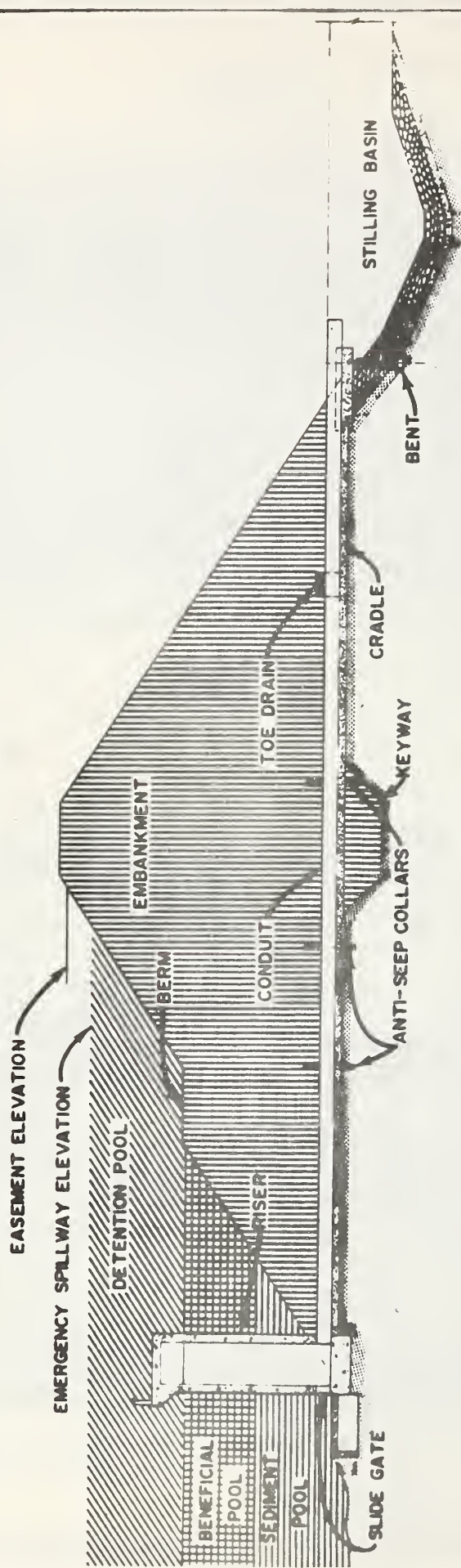
Another view of the same structure showing the dam and concrete riser.

Figure 17



SECTION OF A TYPICAL FLOODWATER RETARDING STRUCTURE

Figure 18



SECTION OF A TYPICAL
MULTIPLE - PURPOSE STRUCTURE

Figure 19

Improvement

The 10 single-purpose structures will control the runoff from 21,958 acres (15%) of the watershed. The two multiple-purpose structures will control an additional 6,413 acres and the total area controlled by structures will be 28,371 acres (20% of watershed).

Structures 4, 13, 16, and 22 are considered as hazard class "a". Structures 1A, 2, 3A, 7A, 10A, 14, and 23 are hazard class "b" while one structure, No. 11, is considered as hazard class "c". However, all structures, with the exception of 11, are designed using "b" criteria; that is, the emergency spillway will operate on the average of once in a 50-year period. The emergency spillway of Structure 11 will operate on the average of only once in a 100-year period. All emergency spillways will be excavated and vegetated while principal spillway systems will consist of reinforced concrete risers with reinforced concrete pipes through the dam.

Foundation conditions for the dam and emergency spillway of the proposed structures will be yielding. Sufficient fill material (silts and clays - MH and ML) for the dam will be available from the emergency spillway areas and sediment pools. All structure sites will be cleared up to the lesser of (a) two feet vertically from the normal pool or (b) 15 feet horizontally from the normal pools. From a point 1.5 feet below the normal pool up to the upper limit of clearing all trees, brush, etc., will be cut off flush with the ground. Below this point tree stumps may be left no higher than one foot above the ground surface.

The 10 floodwater retarding structures will have a total floodwater storage capacity of 7,888 acre-feet. Capacities of individual structures will range from 344 acre-feet of floodwater storage in the smallest structure to 1,574 acre-feet in the largest structure. The total volume allotted for sediment in the structures amounts to 1,750 acre-feet. The floodwater retarding pool (area inundated when all the floodwater storage capacity is used) will range from 25 to 140 surface acres in the individual structures while the height of the dam will range from 37 feet to 63.5 feet.

Multiple-purpose Structure No. 2, to be located on Catheys Creek, will have a compacted earth fill dam (62.5 feet high) with a 36-inch reinforced concrete pipe through the dam. Its reinforced concrete riser will set the elevation of the recreation pool at 1,035.5 feet mean sea level. At this elevation the pool will have 155 surface acres for recreation with 49 of these 155 acres being in the sediment pool. Sediment storage will be 392 acre-feet while 2,000 acre-feet of recreational storage will be provided. The emergency spillway elevation will be at 1046.5 feet mean sea level, enabling the structure to temporarily store 2,025 acre feet of floodwater and control the runoff from 4,314 acres.

Multiple-purpose Structure No. 3A, planned on Little Camp Creek, will have a compacted earthfill dam (52 feet high) with a 30-inch reinforced concrete pipe through the dam. The reinforced concrete riser will set the elevation of the sediment pool at 953.0 feet mean sea level. There will be 103 surface acres for recreation in the structure of which 23 acres are located in the sediment pool. Sediment storage capacity is 137 acre-feet and beneficial storage amounts to 1,476 acre-feet. The emergency spillway will be set at elevation 960.5 feet mean sea level, allowing for the temporary storage of 843 acre-feet of floodwater. Runoff from 2,099 acres will be controlled by Structure No. 3A.

A complete recreational development will be constructed in connection with Structure 2. This development will include camping facilities (primitive and trailer), picnic facilities, sanitary facilities (restrooms, comfort stations, sewage disposal system), swimming and boating facilities, a water and electrical distribution system, access facilities, etc. (See Table 2B and recreational development map for further details). The design of these facilities will be done by a private engineering firm under the provisions of an architectural and engineering contract negotiated by the Soil Conservation Service and the Rutherford County Watershed Commission. Daily design loads and design capacities for the development are as follows:

	<u>Design Load</u>	<u>Design Capacity</u>
Trailer camping	160	160
Primitive camping	200	200
Swimming	800	600
Boating and fishing	210	210
Picnicking	<u>750</u>	<u>500</u>
Total	2,120	1,670

The physical characteristics of the recreation area planned at Structure 2 will allow septic treatment of sewage. Construction of the system will be in compliance with all county health rules and regulations.

State Road 1321 will be raised during the construction of Structure 2. It will be carried across the lake on a causeway.

Recreational facilities will also be designed to accommodate the handicapped.

Structure 3A will have, as a minimum, a public access road, parking lot, boat ramp and dock, and sanitary facilities as part of the water resource improvement for recreation.

The sponsors will discourage recreational use at the 10 single-purpose structures where there will be no public access or sanitary facilities. This will be done by fencing, posting, or patrolling by enforcement officer.

All structures will be constructed in accordance with the North Carolina Division of Health Services' "Regulation on Control of Impounded Water" and will be constructed in accordance with the intent of the North Carolina Sediment Control Act of 1973.

Installation of the proposed structures will involve a certain number of modifications to fixed works of improvement. Following is a summary of those modifications by structure:

<u>Structure</u>	<u>Modification Required</u>
1A	Public road alteration Power line modification Telephone line modification
2	Public road alteration Power line alteration
7A	Public road alteration

Improvement

<u>Structure</u>	<u>Modification Required</u>
11	Public road alteration Power line modification Telephone line modification
14	Public road alteration Power line alteration Telephone line modification
23	Power line alteration

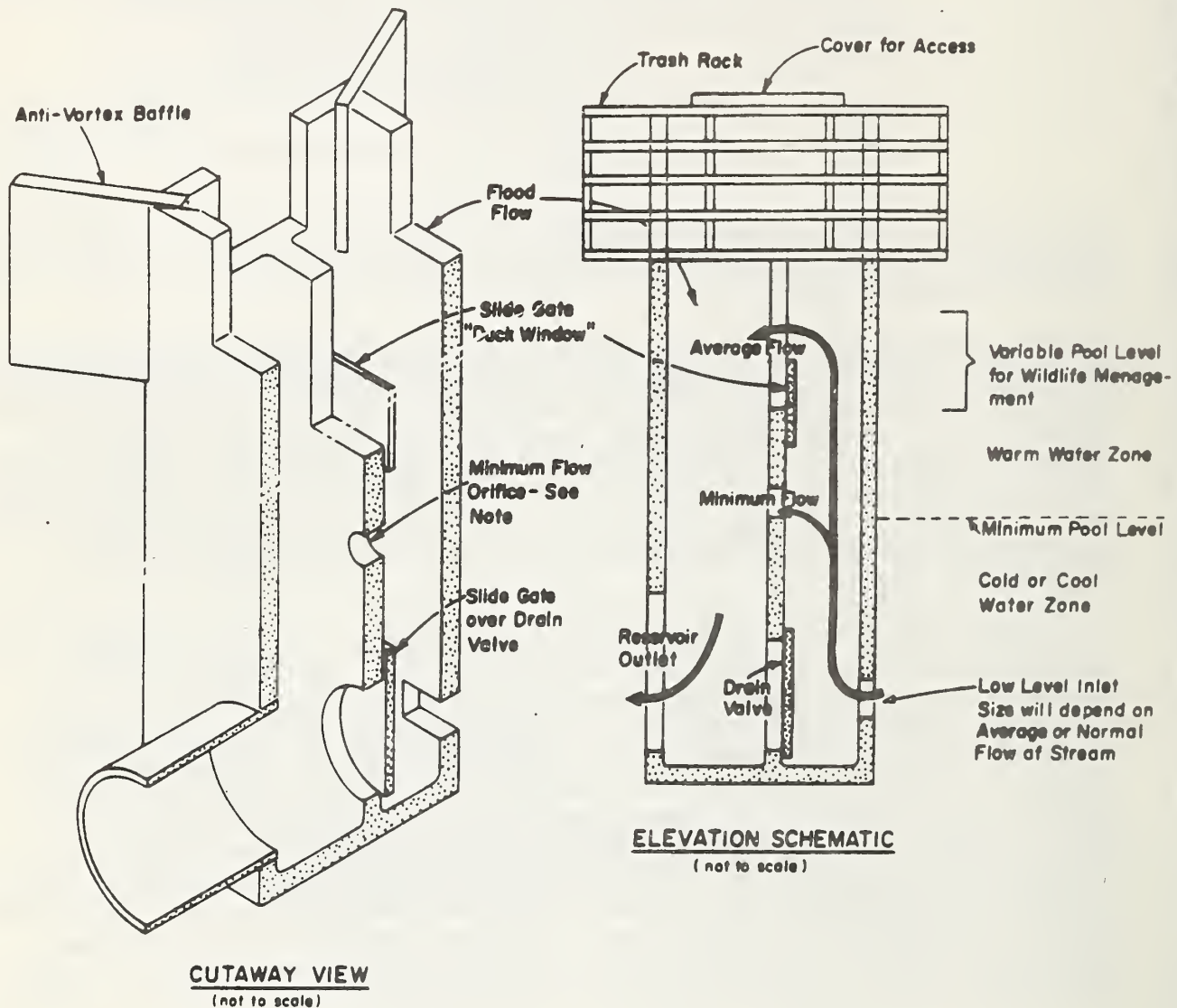
Also involved with structural measures will be the displacement of 12 persons from farms and four persons from dwellings as defined by the Uniform Relocation and Real Property Acquisition Act.

Land rights on 1,449 acres will be required for installation of the proposed structures. The 10 single-purpose structures will require 848 acres for their installation while 405 acres will be needed for Structure 2 and 168 acres for Structure 3A. Flowage easements on about 10 acres will also be needed in connection with No. 2. In addition, 140 acres around Structure 2 (see recreational development map) will have to be purchased for the recreational development and three acres around Structure 3A will be bought to provide public access. Shoreline access will be limited to the recreational development areas of Structures 2 and 3A.

All planned structures will have installed an ungated orifice to provide continuous automatic release from the sediment pool. The purpose of this orifice is to insure that downstream flow will be maintained during periods of minimum inflow to the reservoir. The orifice will be located a minimum of two feet below the sediment pool. (See Figure 20) It will be sized to maintain a downstream flow at least equal to the 10-year, seven-day low flow in the stream; that is, the lowest average flow that could be expected to occur in the stream for seven consecutive days on the average of once in 10 years. This release rate, as obtained from information published by the U. S. Geological Survey, is 0.30 cubic feet per second per square mile of controlled drainage area. Under normal conditions, the water release through this orifice will be negligible when compared to the normal outflow from the structure.

Single-purpose floodwater retarding Structure Nos. 11, 22, and 23 will have duck windows and cold-water release devices installed. The duck window will consist of a movable metal gate which will permit fluctuation of the sediment pool by as much as three feet. (See Figure 20) This will enable duck and wildlife food to be planted along the edge of the water during the spring and summer. During winter these areas can be flooded and waterfowl will have a feeding area.

SCHEMATIC VIEW OF A MINIMUM-FLOW ORIFICE,
DUCK WINDOW, AND COLD-WATER
RELEASE SYSTEM



Note: Minimum Flow Orifice Size will depend on 7 Day 10 Year Minimum Flow of Record.

Minimum Flow Orifice Provides Downstream Flow during Periods of Minimum Inflow to Reservoir.

DROP INLET STRUCTURE WITH INTERIOR WILDLIFE GATE, LOW LEVEL INLET, DRAIN VALVE AND MINIMUM FLOW ORIFICE

4-BSFW-70

PLATE 2

Figure 20

The cold-water release device will consist of an auxiliary riser, open at top and bottom, which will be attached to the principal spillway. A gate will be at the top of the principal spillway so that normal flow will enter the bottom of the auxiliary spillway and be discharged into the principal spillway. (See Figure 20) During periods of heavy inflow, water will enter the top of the principal spillway as well as the auxiliary spillway. By use of this device, water discharged from the structure will normally be coming from the bottom of the pool where water temperatures are cooler.

All exposed embankment areas, spillways, borrow areas, and other areas disturbed during construction will be vegetated. Selected borrow areas will be planted to wildlife and cover plants.

Sediment control during construction will be accomplished by: (a) installation of sediment traps on each side of the stream above and below the dams; (b) installation of diversion above and below borrow areas and other disturbed areas to divert sediment loaded runoff into the sediment traps; (c) clearing only those areas immediately needed for use as construction progresses; and (d) temporary vegetative and mechanical erosion control measures during winter shutdown.

A contract was let with the North Carolina Department of Cultural Resources, Division of Archives and History, for an investigation of the proposed structure sites to determine if there are items of archaeological or historical significance that would be affected by the structures. Based on the investigation, the National Park Service, U.S.D.I., has determined that the six sites recommended in the report for additional investigation and evaluation are eligible for listing in the National Register of Historic Places.

If any previously unidentified evidence of cultural values are discovered during detailed investigations or construction, the National Park Service will be notified and procedures in PL 93-291 followed. Since this is a federally assisted local project, there will be no change in the existing responsibilities of any federal agency under Executive Order 11593 with respect to archaeological and historical resources.

EXPLANATION OF INSTALLATION COSTS

Land Treatment Measures

The installation cost of land treatment on open land is estimated to be \$1,326,480, of which \$269,990 will be from P.L. 566 funds and \$1,056,490 will be from other funds. The P.L. 566 funds include \$246,440 for accelerated technical assistance and \$23,550 for critical area stabilization. The other funds represent the estimated cost of installing land treatment measures (\$956,430), and the value of technical assistance under the going soil and water conservation district program (\$100,060). The cost of technical assistance was based on an analysis of actual Service expenditures and accomplishments for the past several years.

Costs

The cost estimates for installing the forestry phase of the program were developed by the U. S. Forest Service and the N. C. Division of Forest Resources. The total cost of land treatment on forestland is estimated at \$996,700. Of this sum \$187,400 will be provided under P.L. 566, and \$809,300 will be from other funds. The P.L. 566 contribution includes \$62,300 for critical area stabilization, and \$125,100 in technical assistance. Other funds include \$41,400 from the going Cooperative Forest Fire Control Program, and \$56,200 from the going Cooperative Forest Management Program. The technical assistance cost was based on the present cost of the going Cooperative Forest Management Program. The project measure installation cost was based on prices paid by landowners and operators to establish individual measures needed to meet land treatment goals. Industrial owners will furnish the technical assistance on their lands.

Structural Measures

The total installation cost of structural measures is estimated at \$6,585,500 of which \$4,642,202 will be from P.L. 566 funds and \$1,943,298 will be furnished from other funds.

The construction cost of each structural measure is the estimated cost of all material and labor involved in their construction. The costs are based on estimated quantities and the unit costs of previous watershed projects. Included in the construction cost is a contingency allowance of 15 percent to cover unforeseen items in construction.

Engineering services include the cost of engineering surveys, geologic investigations, and final design of structural measures.

Relocation payments cost is the estimated moving and related expenses incurred by the displacements which will result from installation of structural measures. Total relocation payments are estimated to be \$62,000 of which P.L. 566 funds will provide \$35,464 and other funds, \$26,536.

Cost sharing of relocation payments is based upon the ratio of Public Law 566 to other funds for the total project installation cost. Relocation assistance advisory services costs will be born entirely by "other" funds.

Project administration includes the cost of construction inspection, administration of contracts, relocation advisory assistance cost, and other similar items for installing structural measures.

Land rights include expenditures for purchase of land, flowage easements, raising and changing five (5) public roads and bridges, five (5) power lines, three (3) telephone lines, and other changes to fixed improvements. Legal fees incurred in purchase of land are also land rights costs.

The use of facilities method was used to allocate joint costs for both multiple-purpose Structure Nos. 2 and 3A.

Costs

For structural measures, P.L. 566 funds will pay all construction and engineering costs allocated to flood prevention, 50 percent of the construction cost allocated to recreation, and all the engineering cost allocated to recreation.

The estimated total installation cost of the multiple-purpose Structure No. 2 is \$919,500. Construction costs are estimated to be \$530,000 and engineering services \$42,500. Land rights costs amount to \$332,000 and relocation payments are estimated at \$15,000. Public Law 566 funds will pay \$410,008 construction costs; \$42,500 engineering costs; \$8,565 relocation payments; and \$164,000 land rights costs. Other funds will pay \$119,992 construction costs; \$6,435 relocation payments; and \$168,000 land rights costs. Land rights costs include \$3,000 for legal fees, \$1,000 for flowage easements, \$8,000 for moving two houses, \$185,000 for road alterations, and \$7,000 for power line alterations.

The installation costs of Structure No. 2 were allocated \$322,480 to flood prevention and \$547,020 to recreation.

Public Law 566 funds will pay 50 percent of the purchase price of land, changes to fixed improvements, construction costs, and engineering costs of basic recreational facilities to be developed in conjunction with Structure No. 2. The facilities are estimated to cost \$556,150, of which \$276,575 will be from Public Law 566 funds, and \$279,575 by other funds. The Public Law 566 cost is made up of \$231,425 construction costs; \$23,150 engineering costs; and \$22,000 land rights costs. Other funds will pay \$231,425 construction costs; \$23,150 engineering costs; and \$25,000 land rights costs, which include \$3,000 for legal fees, as shown in Table 2. The total installation costs of recreational facilities are allocated to recreation (Table 2A).

The joint costs of Structure No. 3A were allocated \$239,879 to flood prevention and \$361,321 to water resource improvement. Of the amount allocated to water resource improvement (recreation), P.L. 566 funds will pay \$172,400 and other funds \$188,921. Of the entire amount allocated to flood prevention, P.L. 566 funds will pay \$212,210 and other funds will pay \$27,669 for land rights and relocation payments. Public Law 566 funds are for construction, engineering service, and relocation payments. The cost of recreational facilities (\$12,750) allocated to water resource improvement (recreation) will be paid by other funds.

Public Law 566 funds pay the construction costs and engineering costs of single-purpose floodwater retarding structures and mitigation measures for fish and wildlife.

Land rights costs for all structural measures (except Structure No. 2) and for basic facilities, flowage easement costs, administration of contracts costs, and legal fees are local expenses and will be paid for by local funds.

Structure No. 1A land rights costs include \$254,000 for public road alterations, \$2,000 for power lines, and \$500 for telephone lines. The land rights cost for structure No. 11 include \$108,000 for public road alterations, \$23,000 for the purchase of three houses, \$10,500 to move a house and several barns, \$1,000 to dike a house, \$2,000 for power lines and \$2,000 for telephone lines. Land rights costs for Structure No. 14 include \$71,000 for public alterations, \$5,000 for power lines and \$5,000 for telephone lines. Structure No. 23 land rights costs include \$2,000 for power line alterations. Land rights costs for Structure No. 7A include \$218,000 for public road alterations.

Costs

Construction inspection and other administrative costs will be paid from P. L. 566 funds.

The following is a schedule of estimated installation costs:

<u>Year</u>	<u>Land Treatment</u>	
	<u>P. L. 566 Funds</u>	<u>Other Funds</u>
First	\$ 59,960	\$ 230,425
Second	60,100	232,480
Third	59,735	243,110
Fourth	59,735	253,560
Fifth	59,600	242,930
Sixth	52,920	225,200
Seventh	52,920	219,975
Eighth	<u>52,420</u>	<u>218,110</u>
Total	\$ 457,390	\$ 1,865,790

<u>Year</u>	<u>Structural Measures</u>	
	<u>P. L. 566 Funds</u>	<u>Other Funds</u>
First	-	\$ 137,400
Second	\$ 947,700	225,500
Third	821,970	498,000
Fourth	1,102,200	620,800
Fifth	651,020	464,110
Sixth	<u>1,106,800</u>	<u>10,000</u>
Total	\$ 4,629,690	\$ 1,955,810

EFFECTS OF WORKS OF IMPROVEMENTS

Flood Prevention, Erosion and Sediment

When the land treatment program is installed, erosion and sediment will be reduced. Sheet erosion in the watershed will be reduced approximately 35 percent. Critical area erosion (gullies, etc.) will be reduced about 40 percent after stabilization measures are installed. Total erosion from all sources will be reduced from the present 913,110 tons annually to 630,180 tons (30 percent). Sediment delivered into the streams will be reduced from 133,550 tons to 88,500 tons (34 percent). After the land treatment and structural measures are installed, sediment delivered to the mouth of the watershed will be reduced from the present 38,750 tons (119 milligrams per liter) annually to about 17,600 tons (54 milligrams per liter).

As erosion rates are reduced, related sediment damage will also be lowered. Conservation land treatment will control sheet erosion from open farmland, the most significant sediment source in the watershed. The amount of over-bank deposition, or sediment deposited on the flood plain, will be reduced 85 percent.

Effects

With the proposed land treatment installed 50 percent of all cropland and 83 percent of all pastureland and hayland will have adequate conservation treatment. By contributing significantly to the reduction of erosion and the resulting sediment damages to cropland, the program will improve the tilth and moisture holding capacity of the soil which will help in maintaining and improving productivity. The land treatment will tend to slow down the rate of runoff from treated areas, also helping to a certain extent in reducing flooding, although flood runoff cannot be completely eliminated by land treatment. However, with vegetative measures to be installed in the watershed, the runoff rates will be reduced. Land treatment measures which result in deep fertile topsoil, a high level of organic matter, good tilth and vegetative cover, increase the infiltration rate and moisture holding capacity of the soil. This reduces the runoff and makes more water available for crop production.

Although flooding from short, intense rains can be reduced by these measures since they increase the rate of infiltration and water storing capacity of the soil, such land treatment measures have little effect during major floods when the soil is saturated.

The tree planting on 273 acres of land suffering from accelerated erosion will return it to production. Planting of 8,180 acres of trees on open land (2,320) and understocked stands (5,860) will help improve the watershed economy through sale of various products from this land. Other forestry measures include hydrologic stand improvement on 1,577 acres of forestland. The hydrologic condition of the forest soil will be improved. Water runoff will be less, flooding will decrease, erosion from old logging road and skid trails will be reduced and fewer runoff conveyed pollutants will reach flowing streams.

The changes in land use in the watershed will bring about other critically needed adjustments. Presently there are some areas being used for cropland when they are simply not suited. Also, much land is lying idle when it could be converted, for example, to grassland or forestland under the project. About six percent of the cropland in the watershed will be converted to a more suitable use and idle land will be reduced by approximately 97 percent. About 5,117 acres of idle land will be converted to grassland and 1,422 acres will be converted to forestland which will help to reduce its erosion losses. (See Land-Use Change Diagram, p. 65).

Reduced erosion will also lessen the amount of plant nutrients and other agricultural chemicals entering the water from agricultural sources. Stanford and England (32) and Frink (33) have stated that the element phosphorous, for example, is lost to drainage waters mainly through erosion and that erosion control practices tend to control water pollution from this element.

Effects

Since sediment also has been shown to be the major carrier of nitrogen (34) and insecticides (35), erosion control practices are expected to reduce both the possibility of eutrophication of the stream waters from cropland and the possible adverse effects to aquatic resources from pesticides, etc. Land treatment measures will also provide variety, diversity, and edge effect beneficial to wildlife.

Furthermore, the land treatment program will help to reduce the amount of water lost through surface runoff, providing more water for ground water recharge. The water table will be lowered two to three feet on those lands receiving improved drainage, but it will not be lowered enough to significantly affect ground water recharge. Any ground water recharge lost in these areas of improved drainage will be more than compensated for by the impounded water in the 12 structures which will probably result in some increase in ground water recharge around these areas.

Structural measures will reduce flooding and flood damages on 4,684 acres of flood plain land downstream from the floodwater retarding structures.

At the junction of Catheys Creek and Second Broad River (see project map), the reduction in stage and discharge for the 100-year frequency storm is 2.63 feet and 2,100 cubic feet per second. For the six-month frequency storm, the reduction is 129 cubic feet per second and 1.52 feet in stage at this point. At the junction of Robinson Creek and Second Broad River, the reduction in the 100-year frequency flow and stage is 2,100 cubic feet per second and 2.39 feet, respectively. At this location the peak flow and stage for the six-month storm is reduced by 126 cubic feet per second and 0.87 feet, respectively.

Floodwater damages to crops and pasture and to other agricultural property will be reduced by about 83 percent with damage reduction ranging from about 10 percent in Reach 17 to almost 100 percent in Reaches 5 and 12).

The following table shows effects of structural measures in terms of reduction of acres flooded and reduction of flood damages.:

<u>Storm Frequency</u>	<u>Reduction in Acres Flooded</u>	<u>Reduction in Acres Flooded (percent)</u>	<u>Reduction in Flood Damage (percent)</u>
100-year	784	17	32
25-year	931	22	36
10-year	1,171	31	47
5-year	1,101	32	49
2-year	663	29	46
1-year	434	37	59
6-month	192	51	73

The reduction in flooding will permit farmers to plant about 1,963 acres of row crops and 1,084 acres of high yielding pasture in the flood plain below the structures. Increased use of flood plain land will permit converting

1,700 acres of steep upland from cropland and idle land to forest and pasture use, resulting in more efficient use of committed factors of production (land, labor, and capital investment).

Some increased ground water recharge can be expected as a result of the impoundments and their sustained release flows. All sites will have a permanent pool; that is, standing water. Field investigations show no excessive seepage losses are expected from any site. Hence, no large volumes of ground water recharge will occur as a result of the structures. Minor amounts of natural seepage (incidental recharge) will occur throughout the pool areas where exposed rock contains fractures and joints. No practical estimate of this increase in recharge around the impounded areas was made. The quality of water infiltrating the soils and rocks beneath the pools will not adversely affect the quality of the existing ground water resource within the watershed.

As a result of the project, the following changes are expected to take place in crop acreages and yields on the flood plain land.

<u>Crop</u>	<u>Without Project (acres)</u>	<u>With Project (acres)</u>	<u>Without Project (yield)</u>	<u>With Project (yield)</u>
Corn	982	818	75 bu	115 bu
Pasture	724	1,084	4 aum	12 aum
Corn Silage	254	356	15 tons	20 tons
Hay	---	98	---	250 gal
Soybeans	378	440	30 bu	50 bu
Wheat	63	63	45 bu	60 bu

Installation of planned land treatment and structural measures will require adjustments in land use in the watershed. The diagram on page 65 illustrates the general land-use changes resulting from the project.

These land-use changes include the 470 acres (254 forestland and 216 crop and pasture) that will be converted to permanent water and the 725 acres (390 forestland and 335 crop and pasture) that will be within the flood pool and recreation areas of the structures.

Fish and Wildlife and Recreation

The project will, of course, result in destruction of practically all vegetation within the 470 acres to be converted permanently to water.

Effects

However, the tree plantings and the areas managed as wildlife habitat will insure that overall forestland production and wildlife habitat will not be detrimentally affected.

Approximately 10 miles of stream habitat will be converted to reservoir habitat in the upper tributaries of the watershed area (see project map). Only three of the stream reaches with proposed dams are classified in A Catalog of Inland Fishing Waters in North Carolina: Little Camp Creek (Structure 3) and Second Broad River (Structure 11), with an ecological classification of Dace-trickle; and Robinson Creek (Structure 7A), with an ecological classification of sucker. Streams under both classifications generally have a low productive fish capability. Estimated maximum potential sustained annual harvest for streams under these classifications would be: Dace-trickle - 8 lbs/surface acre and sucker - 15 lbs/surface acre (36).

The productivity of water impounded by the structures would be considerably higher than that in the streams before impoundment. Thus, the estimated maximum potential sustained annual harvest would be 100 pounds/surface acre in the three larger reservoirs (Structures 2, 3, and 7A) and a maximum potential of 400 pounds/surface acre in the smaller impoundments (36).

One possible adverse effect of the structures, however, would be that they might block access to the upstream reaches used as spawning areas by fish in Second Broad River and the lower portions of the tributaries. Some of the streams with planned structures may be too small to be of importance as spawning areas.

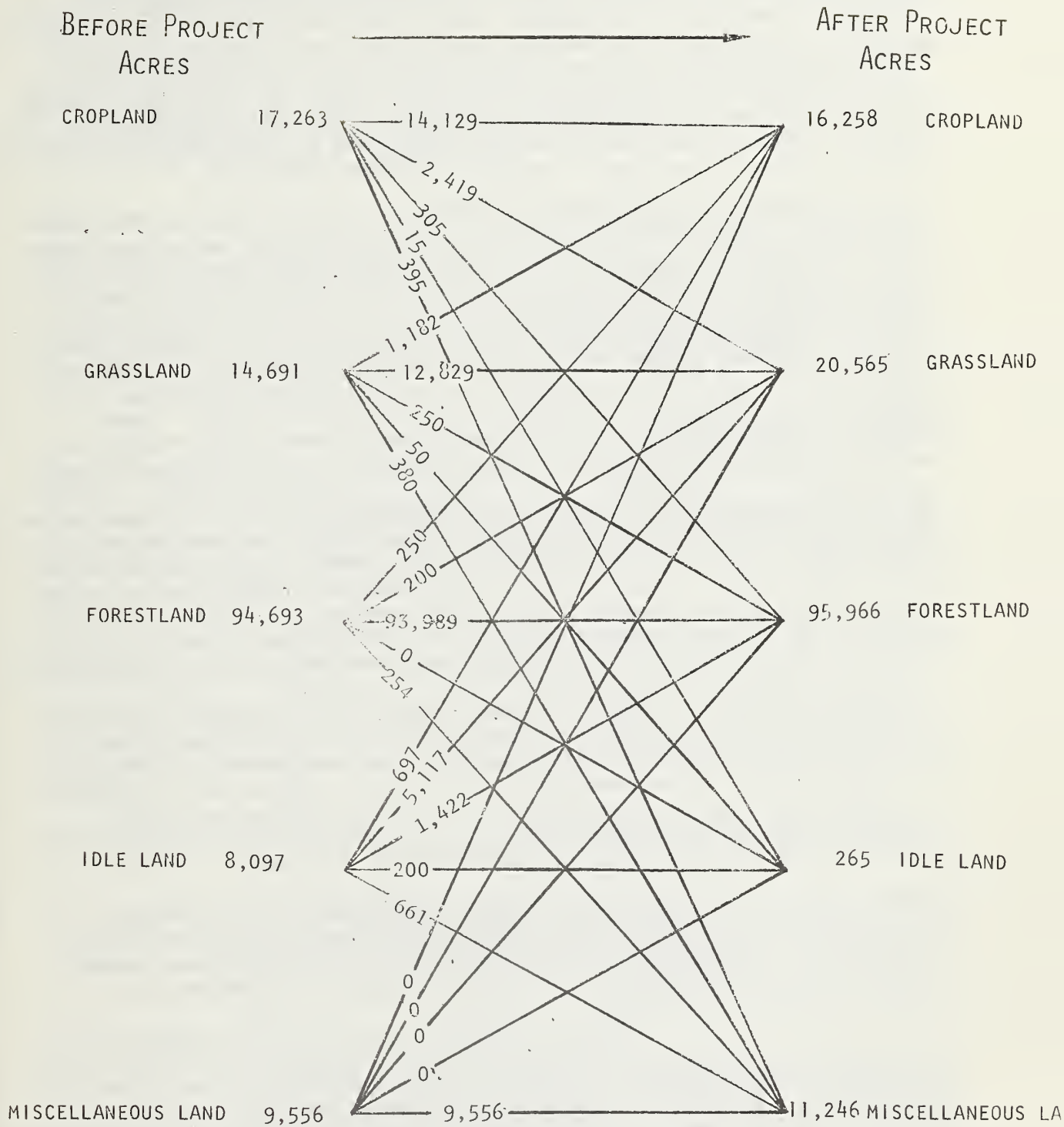
Also analyzed after a review of pertinent literature were effects of the structures on water temperatures and dissolved oxygen levels of the streams where they are to be located.

Considerable information may be found on water temperatures, stratification, dissolved oxygen, etc., in large reservoirs. Therefore, in trying to ascertain possible effects of the structures, we must consider the scientific principles involved.

Impounded water warms up more than that in a stream because of the increased surface area exposed to the sun. Circulation of water in ponds is such that limited stratification of temperature or oxygen occurs. During the summer, top waters become warmer than bottom waters; as a result, only the warm top layer (called the epilimnion) circulates, not mixing with the colder bottom layer (called the hypolimnion) and creating a zone with a steep temperature gradient in between (called the thermocline). If the thermocline is deeper than effective sunlight penetration, the oxygen supply in the hypolimnion is rapidly depleted. If, however, stratified waters are transparent enough to permit growth of phytoplankton below the thermocline, oxygen will be present (37).

Stratified lakes with top-water releases also discharge the warmer surface waters and tend to trap nutrients from upstream. A bottom-water release

LAND-USE CHANGE DIAGRAM



from such lakes would retain the warmer waters and release the colder, nutrient-rich, bottom waters (37). Such releases from an oxygen-poor hypolimnion would be low in oxygen; however, the water is quickly reaerated by stream turbulence. Dillion (38) states that water from the bottom of a floodwater retarding structure picks up oxygen as it goes through the primary outlet and is normally saturated when it comes out below the structure. Due to the turbulence of the water discharging from the structures, the dissolved oxygen levels in the reaches downstream from the proposed structures should therefore be at least as great as present conditions.

Shumacher (39) found that water drawn 10 feet below the surface of a relatively small reservoir (4.3 surface acres) was discharged an average three degrees Fahrenheit warmer than the stream inflow during the summer months. This study was made in the mountains of Georgia where average air and stream temperatures were cooler than would be expected in the Piedmont area. All of the planned Second Broad reservoirs would have more surface area exposed to the sun than in the Georgia study, thereby tending to heat the water more. However, the reservoirs with planned cold-water releases (Structures 11, 22 and 23) range in depth from 20 to 50 feet. These reservoirs should stratify in the summer, causing water being drawn from near the bottom to be as cold or colder than that of the incoming stream.

Any adverse effects to the fishery resources resulting from increased water temperatures and lower dissolved oxygen levels will be avoided in the reaches downstream from Structure Nos. 11, 22 and 23. The other structures will probably tend to warm the waters and reduce the oxygen content in the stream reaches below. However, none of the reaches that will be adversely affected have valuable fishery resources and any adverse effects to aquatic resources resulting from the increased water temperatures will be negligible.

No adverse effects will result to the streams in the watershed from a low flow or base flow standpoint. During periods of normal inflow to the structures, the outflow will approximately equal the inflow, assuring that the normal flow of the stream below the structure remains about the same as it would be with no structures. The low flow orifices on all the planned structures will insure that a flow at least equal to the 10-year, seven-day low flow will occur in the streams at all times.

When installed, the project will enhance the fishery resources in the lower reaches of Second Broad River and in the Broad River by reducing sediment and associated pollutants delivered to these downstream areas. Fish food organism production and spawning success will improve as a result of sediment reduction.

Approximately 470 acres (254 acres forestland and 216 acres crop and pasture) of wildlife habitat will be inundated in the permanent pool area of the 12 impoundments. In addition, due to the recreation development and heavy human use at Structure 2, wildlife habitat in and around the recreation facilities will be detrimentally affected. Also, there are approximately 531 acres (280 forestland and 241 cropland and pastureland) in the flood pool area which will be periodically inundated. The duration of flooding on these lands will be of such a limited extent, however, that their value as wildlife habitat will not be significantly affected. The possible primary

detrimental effect would be increased hazard to reproduction of small game species, such as rabbit and quail.

In addition to being lost to wildlife habitat, the 254 acres of forestland to be converted to permanent water and the 80 acres of forestland in dams and spillways will be lost as timber producing areas. The forestland involved in the areas to be developed for recreation will likewise be reduced in value for commercial production.

Nonetheless, the 323 acres to be managed as upland wildlife habitat and the forestland management program will insure that the overall wildlife habitat remains at least equal to its present value. In fact, this type of management will represent a significant and positive commitment on the part of the landowners to preserve or improve the watershed's overall wildlife habitat. Additionally, land treatment practices, such as mulch planting, critical area stabilization, and field border planting, will also be beneficial to wildlife.

Waterfowl populations can be expected to use all 12 impoundments as resting areas. The duck windows on Structures 11, 22 and 23 should, if properly managed, allow the planting of wildlife food. There will be total of 19 acres of managed waterfowl feeding areas in these three structures. These feeding areas and the other structures will greatly increase the waterfowl habitat within the watershed. The waterfowl habitat at the Bostic brickyard will not be affected by the project.

The need for public water-based recreation will be met by multiple-purpose Structures 2 and 3A. It has been estimated that multiple-purpose Structure 3A will provide an average of 17,000 visitor-days of fishing and boating annually. Structure 2, with facilities for swimming, picnicking, trailer camping, primitive camping, fishing, and boating, will provide an average of 135,000 visitor-days annually with an estimated design capacity of 1,670 visitors.

After installation of the project, watershed residents will have easy access which they do not have now to most types of water-based recreation.

The waterfowl habitat management and the land treatment also should improve hunting conditions within the watershed. Increased populations of upland wildlife resulting from the wildlife management areas and the increased waterfowl populations in the structures will make hunting more attractive.

Archaeological, Historic and Scientific Impacts

Six sites, all aboriginal in content, were identified by the archaeological survey as being affected by structural measures. Rf-54 is a deeply buried site located in the permanent pool of structure No. 7A. Rf-51 is a thickly concentrated site located in the permanent pool of structure No. 3A. The largest aboriginal pottery component encountered in the survey is site Rf-75 found just south of the construction area of structure No. 4. This site would be affected by the access road to the dam. Structure No. 4 would also affect site Rf-74 located in the emergency spillway and construction area.

Site Rf-86 is found in the proposed recreational area of structure No. 2 and Rf-82 is found in the floodpool of structure No. 13.

Economic and Social

Estimates suggest that during the installation period, the project will generate 79 man-years of employment and \$792,000 in wages (at \$10,000 per man-year). The operation and maintenance of structural works and recreational facilities will, directly or indirectly, create six jobs to be filled by local residents. Higher agricultural productivity is expected to generate another 23 jobs.

Multiple-purpose Structures 2 and 3A are expected to provide 152,000 visitor-days of recreation annually to nearby residents. Creation of the lakes will help supply the high demand for water-based recreation in the area as well as improving the quality of life for watershed residents. As a result of recreational activity around the lakes, local businesses such as sporting goods dealers, service stations, bait and tackle shops, etc., will benefit from increased business.

It is estimated that 350 farms will be benefited by the project. More efficient use of land, labor, and capital resources will improve the economic condition of farm families. Reduction in flooding will result in increased production from flood plain soils. An estimated 20 percent of the benefited flood plain is in farms that use one and one-half man-years or more of hired labor.

Installation of the project will result in increased noise, litter, dust, etc., around the area of work during construction. Observation of the project map, however, shows that none of the proposed structures are located within or nearby towns. Therefore, any inconvenience during construction will be limited to those persons living in nearby rural areas and to persons using those roads requiring modifications. But no major disruptions of rural community life as a result of the project are expected. Vector controls, in compliance with North Carolina state law, will be enforced around the construction areas.

It is estimated that securing land rights for structures will cause 16 displacements as defined by the rules and regulations of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970. Four displacements from dwellings and 12 displacements from farms are anticipated.

Displacements at each structure site are as follows:

<u>Structure Site</u>	<u>No. of Displacements</u>	<u>Persons Displaced</u>
1A	2	
2		2
3A	2	
7A	4	
11	2	2
13	1	
14	<u>1</u>	—
Total	12	4

Effects

The law requires that replacement housing be safe, sanitary, and decent regardless of the condition of the present dwelling and also requires that a relocation assistance advisory service be provided. It is the general intent of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 that no displaced person, business, or farm operation shall suffer economic loss as a result of project measures.

PROJECT BENEFITS

The project will provide annual floodwater damage reduction benefits of \$175,200. This amount includes restoration of former productivity benefits. Land treatment measures account for \$35,700 and structural measures account for \$139,500 (Table 6). Benefits from more intensive land use are estimated at \$58,400 annually.

Redevelopment benefits were calculated and use in project justification since the watershed is within the Appalachia region. These benefits will accrue from added employment during project construction and operation and maintenance. They are estimated to average \$57,100 annually.

Public recreation benefits from water resource improvement in Structure No. 3A and recreational development in Structure No. 2 are estimated to average \$220,000 annually.

Local secondary benefits from increased business activity induced by installation of project measures amount to \$56,400 on an annual basis. Secondary benefits from the national point of view were not considered pertinent in the economic evaluation of this project.

COMPARISON OF BENEFITS AND COSTS

The average annual cost of structural measures, including operation and maintenance, is estimated to be \$431,715. Average annual benefits are estimated at \$531,400. The benefit-cost ratio, including local secondary benefits, is 1.2 to 1.0 (Table 6). The benefit-cost ratio without local secondary benefits is 1.1 to 1.0.

PROJECT INSTALLATION

The Rutherford and McDowell Soil and Water Conservation Districts will be responsible for the installation of land treatment measures. The Soil Conservation Service will provide, through the soil and water conservation districts, technical assistance for planning and application (including necessary soil surveys) of land treatment measures. Accelerated technical assistance will be provided to insure application of planned measures during the eight-year project installation period.

Critical sediment source areas to be stabilized with grasses and legumes will be installed on a division of work basis between the Service and the sponsors. Public Law 566 funds will pay the cost of material and sponsors the cost of labor and equipment. The value of work which the Service is to perform does not exceed cost sharing rates for such practices applicable under going programs.

Installation

Forest landowners will be encouraged to supply and maintain the forestry measures on their lands. The U. S. Forest Service will cooperate with the N. C. Division of Forest Resources to provide technical assistance in the planning and application of forest land treatment measures in the watershed. A forester trained in watershed management will be assigned to the project to assist landowners in the installation of the planned measures. Technical assistance will also be provided to assist the landowners and operators in any special problem generated by urban development in the forest areas.

Critical sediment-producing areas to be planted to trees will be installed on a cost-sharing basis with landowners furnishing the trees and P.L. 566 funding the cost of planting.

The soil and water conservation districts will obtain agreements to carry out conservation plans from owners of not less than 50 percent of the lands situated in the drainage area above each floodwater retarding structure before the construction of the structure begins. Also, prior to financial assistance being provided for the construction of a structural measure, at least 75 percent of the effective land treatment measures must be installed or their installation commenced on those critical sediment source areas which would significantly increase construction and maintenance costs if they went uncontrolled.

The Rutherford County Watershed Commission will be responsible for providing, without P.L. 566 assistance, relocation assistance advisory services for the displaced person through the facilities of existing county offices. Decent, safe, and sanitary housing will be provided and the displaced person will be given at least 90 days' notice to move. The Soil Conservation Service will assist the Commission as part of its project administration responsibilities.

The Rutherford County Watershed Commission will have responsible local governments establish floodway regulations from a point below each structure to the confluence with Broad River prior to project construction.

Structural works of improvement are scheduled for installation beginning the second project year and extending through the seventh year. These measures are scheduled as follows:

- Second year - Floodwater retarding Structures Nos. 10A, 14, and 16.
- Third year - Floodwater retarding Structure No. 4, multiple-purpose Structure No. 2.
- Fourth year - Floodwater retarding Structure Nos. 13 and 7A and recreational facilities.
- Fifth year - Floodwater retarding Structure Nos. 1A and 3A with public access.
- Sixth year - Floodwater retarding Structure Nos. 11, 22, and 23.

Installation

All land rights necessary for each contract will be secured prior to the issuance of bids for construction. Water rights are not involved under existing North Carolina laws.

Structural works of improvement will be installed by the Rutherford County Watershed Commission. All items of construction except public roads and power lines will be performed under contracts let, administered, and financed by the Rutherford County Watershed Commission. Public road modifications will be made by the N. C. Division of Transportation and Highway Safety, and power lines will be modified by the Duke Power Company and Rutherford Electric Membership Corporation.

Rutherford County Watershed Commission will develop and maintain a financial management system that will provide for disclosure of the financial results of each Public Law 566 undertaking in which the Soil Conservation Service has a financial interest in accordance with Soil Conservation Service reporting requirements.

The Soil Conservation Service will be responsible for the design of structural works of improvement included in the plan except recreational facilities.

Recreational facilities will be designed by a private engineering firm under provision of an A and E contract negotiated by the Service and the Rutherford County Watershed Commission.

The Rutherford County Watershed Commission has the authority to participate in watershed projects including the power of eminent domain and assessments. This power will be exercised, if necessary, to obtain land rights.

FINANCING PROJECT INSTALLATION

Federal assistance for carrying out the works of improvement described in this work plan will be provided under authority of the Watershed Protection and Flood Prevention Act (P. L. 566) as amended. This assistance is contingent upon the appropriation of funds for this purpose. The sponsoring local organizations have been notified of the provisions of GSA Federal Management Circular 74-4 concerning program income.

The following conditions must be met prior to the Service's providing financial assistance for the construction of any planned structural measures: (1) the sponsoring local organizations will obtain agreement with the landowners to carry out soil and water conservation plans on at least 50 percent of the area above each structural measure; (2) provide for adequate treatment of not less than 75 percent of the critical areas above each structural measure; (3) obtain land rights for each structural measure; and (4) specific operation and maintenance agreements must be executed.

Non-federal costs, including multiple-purpose Structure No. 2 with associated recreational development and multiple-purpose Structure No. 3A, will be provided by the Rutherford County Watershed Commission. The Commission has legal authority to raise funds through taxation and also has the power of eminent domain.

A watershed improvement tax was voted on and passed by watershed residents in 1965. Passage of this tax established permissive legislation which would enable the Commission to collect taxes from watershed residents at up to a maximum rate of five cents per \$100 valuation. At present it has been estimated that this tax has the potential of bringing in \$160,000-\$180,000 per year. As real estate and property values go up, this amount will, of course, increase accordingly. The Commission feels that this tax will provide enough money to meet the local cost-sharing responsibilities at least until the construction of multiple-purpose Structure No. 2. The Commission is aware that it may become necessary to borrow additional money at that time to cover local expenses. If this does not become necessary, charges for use of the structure will help to repay the loan. Although no formal plans or contacts with anyone concerning a loan have yet been made, the Farmers Home Administration has been mentioned by the sponsors as a possible source.

Installation cost of land treatment measures will be provided by individual landowners concerned, P.L. 566 funds, and other funds available through the soil and water conservation district program and other going programs. A considerable part of the landowner's costs will be furnished in the form of labor and use of farm equipment. The present rate of technical assistance and cost sharing for critical area planting will be from P.L. 566 funds by the Soil Conservation Service and the U.S. Forest Service. Critical area stabilization will be installed by landowners or operators and the Rutherford County Watershed Commission. The Rural Environmental Conservation Program will be available to landowners for cost sharing of conservation practices on open land and the Forest Incentives Program is available for cost sharing of practices on forestland.

The N. C. Division of Forest Resources will provide \$11,800 for accelerated technical assistance, a capital outlay of 41,400 under the going Cooperative Forest Fire Control Program, and additional services valued at \$56,200 under the going Cooperative Forest Management Program.

Prior to entering into agreements that obligate funds of the Service, the Rutherford County Watershed Commission will have a financial management system for control, accountability, and disclosure of P.L. 566 funds received, and for control and accountability for property and other assets purchased with P.L. 566 funds.

Program income earned during the grant period will be reported on the sponsor's request for advance or reimbursement from the Service.

PROVISIONS FOR OPERATION AND MAINTENANCE

Land treatment measures on open land will be maintained by the landowners or operators of the land on which these measures will be installed. Such maintenance will be promoted and encouraged through the soil and water conservation districts, with technical assistance furnished by the Soil Conservation Service.

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The district supervisors, or their representatives, will make an annual review of the installed land treatment measures to insure adequate maintenance. Provisions for the maintenance of critical area plantings will be included in the soil and water conservation plan for the individual farm where the plantings are located. Landowners and operators will maintain the forest land treatment measures under agreement with the Rutherford Soil and Water Conservation Districts and the McDowell Soil and Water Conservation District. The N.C. Division of Forest Resources in cooperation with the U.S. Forest Service will provide technical assistance necessary under the going Co-operative Forest Management Program and multiple use aspects. It will also continue to furnish fire protection under the present Co-operative Fire Control Program.

The Rutherford County Watershed Commission will be responsible for the operation and maintenance of all structural measures and may carry out these responsibilities with its staff or arrange for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work. Funds for the operation and maintenance of structural measures will also be provided by the Rutherford County Watershed Commission.

The operation and maintenance agreement will include specific provisions for retention and disposal of property acquired or improved with P.L. 566 financial assistance.

The 10 single -purpose floodwater retarding structures and the two multiple-purpose structures will be properly operated and maintained to serve their designed purpose. Since no public access or sanitary facilities will be provided at the single-purpose structures, the sponsors will discourage public use by fencing, posting or patrolling by enforcement officers. Estimated annual cost of operation and maintenance of these structures is \$9,500. Maintenance will consist of but not be limited to:

- A. Removal and disposal of debris from the principal and emergency spillways.
- B. Refilling, smoothing, and vegetating of rilling on embankments, spillway, and borrow areas.
- C. Mowing of embankments, spillways, and borrow areas, as needed, to control woody growth.
- D. Maintaining good vegetative cover on spillways, embankments, and borrow areas.
- E. Required replacement of metal used in construction.

Cost of operating and maintaining the recreational development in and around Structure No. 2 is estimated at \$34,000. The operation and maintenance of the development will consist of but not be limited to:

A. Services

Superintendent

Semi-skilled labor, such as carpenters, mechanics, etc.

Laborers for ground care, road repairs, trash pickup, etc.

Lifeguards

Workmen's Compensation, medical, and other worker benefits.

B. Operating Supplies

Seed, fertilizer, paint, lumber, etc.
Repair parts for water systems, machinery, etc.
Utilities (telephone, electricity, etc.)
Sanitary supplies (soap, paper supplies, etc.)

C. Equipment and Replacement as Needed

Maintenance shop, office, and furnishings
Tractors
Pickup or other truck for refuse collection, etc.
Boat and motor for rules enforcement and emergencies
Beach equipment
Playground and sports equipment
Handtools and minor equipment

Although plans for full recreational development of multiple-purpose Structure No. 3A have not been developed, public access will be provided. Sanitary facilities which will form the nucleus of the development will be operated and maintained under standards equal to, or better than, state requirements.

The operation of the duck windows in Structure Nos. 11, 22, and 23, will include the following provisions:

- A. Metal gates will be fully opened not earlier than April 1, but not later than May 15 of each year.
- B. The area exposed by lowering the water level within the lakes will be fertilized and seeded to suitable duck food plants as early in the spring as weather conditions permit.
- C. Metal gates will be fully closed not earlier than October 1 but not later than October 15 of each year.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST

Second Broad River Watershed
McDowell, Rutherford, and Cleveland Counties, North Carolina

Installation Cost Item	Unit	Number	Estimated		Cost	Dollars/		
			Non-Federal Land	P.L. 566		Non-Federal Land	Other	Total
			FS	FS		FS	FS	
LAND TREATMENT								
Land Areas ^{2/}								
Cropland	Acres	3,470				125,490		125,490
Grassland	to	11,772				708,250		708,250
Forest Land	be	23,950					679,000	679,000
Other Land	Treated	393				99,140		99,140
Going Cooperative Forest Fire Control Program							41,400	41,400
Critical Area Stabilization		273		62,300	62,300			
Tree planting		157					10,600	10,600
Grasses and legumes			23,550		23,550			23,550
Technical Assistance			246,440	125,100	371,540	100,060	78,300 ^{3/}	178,360
TOTAL LAND TREATMENT			269,990	187,400	457,390	1,056,490	809,300	1,865,790
								2,323,180
STRUCTURAL MEASURES								
Construction	No.	10	2,468,700		2,468,700			2,468,700
Floodwater Retarding Structures						267,237		267,237
Multiple Purpose Structures	No.	2	752,763		752,763			1,020,000
Recreational Facilities			231,425		231,425	241,925		241,925
Subtotal Construction			3,452,888		3,452,888	509,162		3,962,050
Engineering Services			344,350		344,350			24,200
Relocation Payments			35,464		35,464	26,536		26,536
Project Administration								
Construction Inspection			367,500		367,500			367,500
Other			256,000		256,000	23,700		279,700
Relocation Assistance Advisory Services						500		500
Subtotal Administration			623,500		623,500	24,200		24,200
Other Costs								
Land Rights			186,000		186,000	1,359,200		1,545,200
TOTAL STRUCTURAL MEASURES			4,642,202		4,642,202	1,943,298		1,943,298
TOTAL PROJECT			4,912,192	187,400	5,099,592	2,999,788	809,300	3,809,088
								8,908,680

1/ Price base: 1974

2/ Includes only areas estimated to be adequately treated during the project installation period.

Treatment will be accelerated throughout the watershed and dollar amounts apply to total land areas

3/ Includes \$56,200 from going Cooperative Forest Management Program

Date: January 1975

TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT
(at time of Work Plan preparation)

Second Broad River Watershed
McDowell, Rutherford, and Cleveland Counties, North Carolina

Measures	Unit	Applied to date	Total Cost (Dollars) ^{1/}
<u>LAND TREATMENT</u>			
Conservation Cropping System	Ac	10,295	41,180
Crop Residue Management	Ac	5,050	15,150
Contour Farming	Ac	8,600	25,800
Field Border	Ft	25,000	500
Grassed Waterway	Ac	170	59,500
Strip Cropping	Ac	200	3,000
Minimum Tillage	Ac	400	2,400
Diversions	Ft	13,000	1,040
Terracing	Ft	1,001,000	60,060
Drainage Main or Laterals	Ft	12,000	4,200
Drain	Ft	25,000	17,500
Pasture and Hayland Management	Ac	5,000	250,000
Pasture and Hayland Planting	Ac	14,600	1,460,000
Ponds	No.	80	160,000
Tree Planting	Ac	3,600	118,800
Woodland Improvement	Ac	1,800	12,600
Critical Area Planting	Ac	1,076	269,000
TOTAL			2,500,730

^{1/} Price base: 1974

Date: January 1975

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION

Second Broad River Watershed
McDowell, Rutherford, and Cleveland Counties, North Carolina

(Dollars) 1/

Item	Installation Cost - P.L. 566 Funds			Installation Cost - Other Funds			Total	
	:Relocation:			:Relocation:			:Total:	
	Construction:Engineering	Payments	Land Rights:P.L.566:Construction:Engineering	Payments	Land Rights	Other:Cost	Installation	Total
Floodwater Retarding Structures:								
No. 1A	156,000	15,600	2,060	174,455	2,140	286,500 ^{2/}	288,645	463,100
No. 4	211,000	21,100		232,100		46,800	46,800	278,900
No. 7A	366,000	32,900	5,720	404,610	4,280	286,800 ^{3/}	291,090	695,700
No. 10A	194,000	19,400		213,400		14,800	14,800	228,200
No. 11	269,900	27,000	12,584	309,462	9,416	255,100 ^{4/}	264,538	574,000
No. 13	246,000	24,600	1,430	272,027	1,070	42,000	43,073	315,100
No. 14	145,000	14,500	1,430	160,928	170	102,600 ^{5/}	103,672	264,600
No. 16	276,000	27,600		303,600		20,000	20,000	323,600
No. 22	250,900	25,100		276,000		22,800	22,800	298,800
No. 23	353,900	31,900		385,800		20,400 ^{6/}	20,400	406,200
Multiple-purpose Structure:								
No. 2	410,008	42,500	8,580	164,000 ^{7/}	119,992	168,000 ^{7/}	294,427	919,500
Recreational Facilities	231,425	23,150		22,000	231,425	25,000 ^{8/}	279,575	556,150
Multiple-purpose Structure:								
No. 3A	342,755	39,000	2,860	384,610	147,245	67,200	216,590	601,200
Recreational Facilities				10,500		1,200	12,750	
Subtotal	3,452,888	344,350	35,464	186,000	509,162	1,359,200	1,919,098	5,937,800
				623,500				
Project Administration								
GRAND TOTAL	3,452,888	344,350	35,464	186,000	509,162	1,359,200	1,943,298	6,585,500
				24,200	26,536	647,700		

1/ Price base: 1974

2/ Includes \$254,000 for public road alterations, \$2,000 for power lines and \$500 for telephone lines.

3/ Includes \$218,000 for public road alterations.

4/ Includes \$108,000 for public road alterations, \$23,000 for purchase of three houses, \$10,500 to move a house and several barns, \$1,000 to dike a house, \$2,000 for power lines, and \$2,000 for telephone lines.

5/ Includes \$71,000 for public re-4 alterations, \$5,000 for power lines and \$5,000 for telephone lines.

6/ Includes \$2,000 for power line alterations.

7/ Includes \$8,000 for moving two (2) houses, \$185,000 for road alterations, \$7,000 for power line alterations, \$3,000 for legal fees, and \$1,000 for flowage easements.

8/ Includes \$3,000 for legal fees.

Date January 1975

TABLE 2A - COST ALLOCATION AND COST SHARING SUMMARY

Second Broad River Watershed
McDowell, Rutherford, and Cleveland Counties, North Carolina

(Dollars)^{1/}

Item	COST ALLOCATIONS				COST SHARING				OTHER			
	PURPOSE				P.L. 566							
	Flood	Water Resource	Improvement	Recreation	Flood	Water Resource	Improvement	Recreation	Flood	Water Resource	Improvement	Recreation
	Prevention	Prevention	Prevention	Prevention	Prevention	Prevention	Prevention	Prevention	Prevention	Prevention	Prevention	Prevention
	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total
Floodwater Retarding Structure Nos. 1A, 4, 7A, 10A, 11, 13, 14 16, 22, and 23	3,848,200				3,848,200	2,732,382			2,737,382	1,115,818		
Recreational Development No. 2: Structure No. 2 Land Rights Flowage Easements Legal Fees Recreational Facilities	321,480 266,020 328,000 1,000 3,000 556,150				587,500 328,000 1,000 3,000 556,150	317,959 143,114 164,000 276,575			461,073 164,000 1,000 279,575	3,521 164,000 1,000 279,575		
Water Resource Improvement No. 3A Recreational Facilities	239,879				601,200 12,750	212,210 172,400			384,610 27,669	188,921 12,750		
GRAND TOTAL	4,410,559	1,153,170	5,937,800	3,262,551	5,937,800	583,689	172,400	4,018,640	1,148,008	569,481	201,671	1,915,160

1/ Price base: 1974

TABLE 2B - RECREATIONAL FACILITIES

ESTIMATED CONSTRUCTION COSTS

Second Broad River Watershed
McDowell, Rutherford, and Cleveland Counties, North Carolina

(Dollars)^{1/}

Item	: : Number ^{2/}	: Estimated: : Unit : Cost	: Total : Construction : Cost
Swimming beach	30,000 sq. ft.	.53	15,900
Camp sites:			
Primitive	50	215	10,750
Trailer	40	1,600	64,000
Boat ramp and dock	1	6,400	6,400
Picnic tables	125	170	21,250
Refuse stands	88	45	3,960
Grills	88	65	5,720
Water faucets	50	24	1,200
Bathhouse	1	16,000	16,000
Restrooms/with showers	3	10,600	31,800
Comfort stations	2	7,400	14,800
Water fountains	4	100	400
Parking spaces (gravel):			
Car	260	212	55,120
Car and boat trailer	35	425	14,875
Roads:			
Paved	1 mile	53,000	53,000
Gravel	0.5 mile	37,000	18,500
Water supply (wells, pumps, storage, distribution, etc.)			53,000
Sewer system (Tanks, lines etc.)			53,000
Electric distribution system			5,300
Fencing, landscaping, identification signs, beach equipment, etc.			17,875
GRAND TOTAL	xxxxxx	xxxxxx	462,850

^{1/} Price base: 1974

^{2/} Estimated quantity, subject to minor variation at time of detailed planning.

Date: January 1975

TABLE 3 - STRUCTURAL DATA

STRUCTURES WITH PLANNED STORAGE CAPACITY

Second Broad River Watershed
McDowell, Rutherford and Cleveland Counties, North Carolina

Item	Unit	Structure Number		
		1A	2	3A
Class of Structure		b	b	b
Drainage Area	Sq. Mi.	4.50	6.74	3.28
Curve No. (1-day) (AMC II)		66	69	65
Tc	Hrs.	2.11	1.98	1.27
Elevation Top of Dam	Ft.	1012.0	1053.5	964.5
Elevation Crest Emergency Spillway	Ft.	1007.0	1046.5	960.5
Elevation Crest High Stage Inlet	Ft.	987.5	1035.5	956.0
Elevation Crest Low Stage Inlet	Ft.	-	-	953.0
Maximum Height of Dam	Ft.	44	62.5	52
Volume of Fill	Cu. Yds.	56,200	197,500	200,000
Total Capacity	Ac. Ft.	1150	4417	2456
Sediment submerged 100 years	Ac. Ft.	185	294	124
Sediment aerated	Ac. Ft.	19	98	13
Beneficial use (Recreation)	Ac. Ft.	-	2,000	1476
Retarding	Ac. Ft.	946	2,025	843
Between high and low stage	Ac. Ft.	-	-	350
Surface Area				
Sediment pool	Acres	28	49	23
Beneficial use pool (Recreation)	Acres	-	155	103
Retarding pool	Acres	69	277	134
Principal Spillway				
Rainfall volume (areal) (1-day)	In.	8.0	8.2	8.0
Rainfall volume (areal) (10-day)	In.	15.8	15.8	14.0
Runoff volume (10-day)	In.	7.39	8.20	5.85
Capacity of low stage (Max.)	cfs.	-	-	36
Capacity of high stage (Max.)	cfs.	115	189	120
Frequency operation-Emer.Spillway	% chance	2	2	2
Size of conduit	Dim.	30	36	30
Emergency Spillway				
Rainfall volume (ESH) (areal)	In.	8.7	8.9	8.8
Runoff volume (ESH)	In.	4.59	5.13	4.54
Type	veg.	veg.	veg.	veg.
Bottom width	Ft.	200	200	150
Velocity of flow (V)	Ft./Sec.	3.93	-	3.72
Slope of exit channel	Ft./Ft.	.040	.040	.040
Maximum water surface elevation	Ft.	1008.0	1046.0	961.5
Freeboard				
Rainfall volume (FH) (areal)	In.	15.6	15.6	15.6
Runoff volume (FH)	In.	10.77	11.26	10.59
Maximum water surface elevation	Ft.	1012.0	1053.3	964.5
Capacity Equivalents				
Sediment volume	In.	0.85	1.09	0.78
Retarding volume	Inc.	3.94	5.63	4.82

TABLE 3 - STRUCTURAL DATA (Con't.)

STRUCTURES WITH PLANNED STORAGE CAPACITY

Second Broad River Watershed
McDowell, Rutherford and Cleveland Counties, North Carolina

Item	Unit	Structure Number		
		4	7A	10A
Class of Structure		a	b	b
Drainage Area	Sq. Mi.	3.07	7.50	1.68
Curve No. (1-day) (AMC II)		69	68	66
Tc	Hrs.	2.04	1.87	1.16
Elevation Top of Dam	Ft.	943.5	1021.5	1331.0
Elevation Crest Emergency Spillway	Ft.	940.0	1015.0	1327.0
Elevation Crest High Stage Inlet	Ft.	932.5	993.5	1319.5
Elevation Crest Low Stage Inlet	Ft.	923.0	-	1307.5
Maximum Height of Dam	Ft.	39.0	50.5	51
Volume of Fill	Cu. Yds.	81,400	178,400	61,000
Total Capacity	Ac. Ft.	1042	1995	446
Sediment submerged 100 years	Ac. Ft.	130	391	90
Sediment aerated	Ac. Ft.	13	43	6
Beneficial use (Recreation)	Ac. Ft.	-	-	-
Retarding	Ac. Ft.	899	1561	350
Between high and low stage	Ac. Ft.	382	-	188
Surface Area				
Sediment pool	Acres	26	43	11
Beneficial use pool (Recreation)	Acres	-	-	-
Retarding pool	Acres	90	120	25
Principal Spillway				
Rainfall volume (areal) (1-day)	In.	8.1	7.3	8.0
Rainfall volume (areal) (10-day)	In.	15.8	13.9	14.2
Runoff volume (10-day)	In.	8.20	6.47	6.21
Capacity of low stage (Max.)	cfs	37	-	31
Capacity of high stage (Max.)	cfs	109	179	118
Frequency operation-Emer.Spillway	% chance	2	2	2
Size of Conduit	Dim	30	36	30
Emergency Spillway				
Rainfall volume (ESH) (areal)	In.	8.9	8.7	8.8
Runoff volume (ESH)	In.	5.12	4.83	4.67
Type	veg.	veg.	veg.	veg.
Bottom width	Ft.	200	200	150
Velocity of flow (V)	Ft./Sec.	2.89	5.7	4.15
Slope of exit channel	Ft./Ft.	0.040	.034	.039
Maximum water surface elevation	Ft.	940.6	1017.0	1328.1
Freeboard				
Rainfall volume (FH) (areal)	In.	15.6	15.5	15.6
Runoff volume (FH)	In.	11.26	11.01	10.77
Maximum water surface elevation	Ft.	943.5	1021.5	1331.0
Capacity Equivalents				
Sediment volume	In.	0.87	1.09	1.07
Retarding volume	In.	5.49	3.90	3.90

TABLE 3 - STRUCTURAL DATA (con't.)

STRUCTURES WITH PLANNED STORAGE CAPACITY

Second Broad River Watershed
McDowell, Rutherford and Cleveland Counties, North Carolina

Item	:	:	Structure Number			
			11	13	14	16
Class of Structure			c	a	b	a
Drainage Area	Sq.Mi.		6.72	2.70	1.57	2.27
Curve No. (1-day) (AMC II)			65	69	66	66
Tc	Hrs.		2.01	2.14	1.25	1.29
Elevation Top of Dam	Ft.		1316.1	1030.0	966.5	981.0
Elevation Crest Emergency Spillway	Ft.		1312.3	1025.0	962.5	975.5
Elevation Crest High Stage Inlet	Ft.		1294.5	1019.0	957.0	958.5
Elevation Crest Low Stage Inlet	Ft.		-	1010.0	950.0	948.5
Maximum Height of Dam	Ft.		41.0	38.0	37	61
Volume of Fill	Cu.Yds.		61,000	86,000	43,000	80,000
Total Capacity	Ac.Ft.		1880	813	427	508
Sediment submerged 100 years	Ac.Ft.		271	141	75	69
Sediment aerated	Ac.Ft.		35	16	8	8
Beneficial use (Recreation)	Ac.Ft.		-	-	-	-
Retarding	Ac.Ft.		1574	656	344	431
Between high and low stage	Ac.Ft.		-	302	160	90
Surface Area						
Sediment pool	Acres		35	23	16	7
Beneficial use pool (Recreation)	Acres		-	-	-	-
Retarding pool	Acres		140	69	41	30
Principal Spillway						
Rainfall volume (areal) (1-day)	In.		9.0	7.5	8.0	8.0
Rainfall volume (areal) (10-day)	In.		16.0	14.1	14.2	14.2
Runoff volume (10-day)	In.		7.40	6.81	6.21	6.14
Capacity of low stage (Max.)	cfs		-	36	24	29
Capacity of high stage (Max.)	cfs		181	103	101	126
Frequency operation-Emer.Spillway	% chance		1	2	2	2
Size of conduit	Dim		36	30	30	30
Emergency Spillway						
Rainfall volume (ESH) (areal)	In.		8.8	9.0	8.8	8.7
Runoff volume (ESH)	In.		4.54	5.21	4.67	4.59
Type	veg.		veg.	veg.	veg.	veg.
Bottom width	Ft.		400	100	100	100
Velocity of flow (V)	Ft./Sec.		.15	4.88	3.75	5.13
Slope of exit channel	Ft./Ft.		.040	.035	.040	.034
Maximum water surface elevation	Ft.		1312.4	1026.5	963.5	977.1
Freeboard						
Rainfall volume (FH) (areal)	In.		15.6	15.6	15.6	15.5
Runoff volume (FH)	In.		10.59	11.26	10.77	10.67
Maximum water surface elevation	Ft.		1316.1	1030.0	966.5	980.8
Capacity Equivalents						
Sediment volume	In.		0.85	1.09	0.99	0.64
Retarding volume	In.		4.39	4.56	4.11	3.56

TABLE 3 - STRUCTURAL DATA (Cont'd.)

STRUCTURES WITH PLANNED STORAGE CAPACITY

Second Broad River Watershed
McDowell, Rutherford, and Cleveland Counties, North Carolina

Item	Unit	Structure Number		Total
		22	23	
Class of Structure		a	b	
Drainage Area	Sq. Mi.	2.23	2.07	44.33
Curve No. (1-day) (AMC II)		69	69	-
Tc	Hrs.	1.47	1.18	-
Elevation Top of Dam	Ft.	1012.0	1066.0	-
Elevation Crest Emergency Spillway	Ft.	1007.0	1061.0	-
Elevation Crest High Stage Inlet	Ft.	996.5	1049.0	-
Elevation Crest Low Stage Inlet	Ft.	984.0	1032.0	-
Maximum Height of Dam	Ft.	61.0	59.0	-
Volume of Fill	Cu. Yds.	100,000	170,000	1,303,900
Total Capacity	Ac. Ft.	677	700	16,511
Sediment submerged 100 years	Ac. Ft.	116	96	1,982
Sediment aerated	Ac. Ft.	14	24	297
Beneficial use (Recreation)	Ac. Ft.	-	-	3,476
Retarding	Ac. Ft.	547	590	10,756
Between high and low stage	Ac. Ft.	249	275	1,996
Surface Area				
Sediment pool	Acres	13	10	284
Beneficial use pool (Recreation)	Acres	-	-	258
Retarding pool	Acres	39	30	1,064
Principal Spillway				
Rainfall volume (areal) (1-day)	In.	8.0	8.1	-
Rainfall volume (areal) (10-day)	In.	15.0	15.5	-
Runoff volume (10-day)	In.	7.50	7.95	-
Capacity of low stage (Max.)	cfs	31	40	-
Capacity of high stage (Max.)	cfs	125	130	-
Frequency operation-Emer.Spillway	% chance	2	2	-
Size of conduit	Dim	30	30	-
Emergency Spillway				
Rainfall volume (ESH) (areal)	In.	8.9	8.9	-
Runoff volume (ESH)	In.	5.12	5.13	-
Type	veg.	veg.	veg.	-
Bottom width	Ft.	100	100	-
Velocity of flow (V)	Ft./Sec.	4.17	-	-
Slope of exit channel	Ft./Ft.	.039	.036	-
Maximum water surface elevation	Ft.	1008.1	1061.0	-
Freeboard				
Rainfall volume (FH) (areal)	In.	15.8	15.6	-
Runoff volume (FH)	In.	11.45	11.26	-
Maximum water surface elevation	Ft.	1012.0	1061.0	-
Capacity Equivalents				
Sediment volume	In.	1.09	1.09	-
Retarding volume	In.	4.60	5.34	-

Date: January 1975

TABLE 4 - ANNUAL COST

Second Broad River Watershed
McDowell, Rutherford, and Cleveland Counties, North Carolina

(Dollars)^{1/}

Evaluation Unit	Amortization of Installation Cost ^{2/}	Operation and Maintenance	Total
All Structural Measures	350,035	43,500 ^{3/}	393,535
Project Administration	38,180	xxxxxx	38,180
TOTAL	388,215	43,500	431,715

^{1/} Price base: 1974 prices.

^{2/} Amortized at 5-7/8 percent interest rate for 100 years.

^{3/} Includes \$34,000 O&M - Recreation Development.

Date: January 1975

TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD DAMAGE REDUCTION BENEFITS

Second Broad River Watershed
McDowell, Rutherford and Cleveland Counties, North Carolina

(Dollars)^{1/}

	: Estimated Average Annual Damage :		Damage
	: Without	: With	: Reduction
Item	: Project	: Project	: Benefit
Floodwater:			
Crop and Pasture	79,000	25,300	53,700
Other Agricultural	21,000	9,800	11,200
Non-agricultural			
Roads & Bridges	23,300	4,000	19,300
Subtotal	123,300	39,100	84,200
Sediment:			
Overbank Deposition	35,100	13,900	21,200
Reservoirs	67,500	30,500	37,000
Industrial Water			
Supply	28,000	18,000	10,000
Subtotal	130,600	62,400	68,200
Indirect	38,400	15,600	22,800
TOTAL	292,300	117,100	175,200

^{1/} Price base: Adjusted normalized and 1974

Date: January 1975

TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Second Broad River Watershed
McDowell, Rutherford, and Cleveland Counties, North Carolina

(Dollars)

Evaluation Unit	Average		Annual		Benefits ^{1/}		Average		Benefit	
	Damage Reduction	Intensive Land Use	Secondary Recreation	Development	Redevelopment	Total	Annual Cost	Annual Cost	Cost Ratio	Benefit Cost Ratio
All Structural Measures	139,500	58,400	56,400	220,000	57,100	531,400	393,535		1.4:1.0	
Project Administration	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx	36,580		xxxxx	xxxxx
GRAND TOTAL	139,500 ^{3/}	58,400	56,400	220,000	57,100	531,400	431,715		1.4:1.0	

1/ Price base: Adjusted Normalized and 1974

2/ From Table 4

3/ In addition, it is estimated that land treatment measures will provide flood damage reduction benefits of \$35,700 annually.

Date: January 1975

INVESTIGATIONS AND ANALYSES

Hydraulics and Hydrology

Cross sections, including road and bridge sections, were taken to represent the flood plain area and to properly reflect the hydraulic conditions.

Stage-discharge and stage-area inundated relationships "without" and "with" channel clearing and snagging and obstruction removal were obtained with the use of the electronic computer, IBM 1130, in accordance with procedures developed by the Engineering and Watershed Planning Unit in Fort Worth, Texas.

Roughness coefficients used in the hydraulics program were estimated in accordance with procedures outlined in Supplement B, Section 5, National Engineering Handbook. These coefficients were reduced approximately 25 to 30 percent in those reaches where channel work is proposed. This will increase velocities, thereby improving channel capacities but not causing any bank instability.

Soil-cover-complex runoff curve numbers were computed for the watershed and each structure site. Soil and cover conditions were mapped for the total watershed. Runoff curve numbers for wooded areas were furnished by the U. S. Forest Service. Weather Bureau Technical Publication No. 40 was used to obtain rainfall amounts for the purpose of flood routing. The Log Pearson Type III Frequency Analysis was run on the gaging stations in the watershed, and used for comparison with the flood routed peaks.

Flood routing for future without project and future with structures with channel clearing and snagging and obstruction removal was performed with the use of the electronic computer, based on the procedure outlined in the Washington Technical Release No. 20. It was found that the future without project routed peaks were excessive when compared to the Log Pearson Frequency Analysis and also when compared with the peaks of publication Floods in North Carolina - Magnitude and Frequency. From these comparisons, it was decided to use the Unit Hydrograph Factor of 256, rather than the Factor 484, in the hydrology program. It was also decided to use a runoff curve number adjustment in conjunction with the new hydrograph factor. By so doing, the flood routed peaks were more realistic and in line with the compared.

An array of seven frequency storms of 24 hours' duration was used in the analysis - the 100-year, 25-year, 10-year, 5-year, 2-year, 1-year, and 6-month.

Engineering

Aerial photographs with a scale of 3.168 inches per mile were used. All vertical control for structural measures was based on mean sea level datum as established by the U. S. G. S. bench marks in the area. Temporary bench marks were established within the watershed by differential leveling.

Investigations

Topographic surveys with U. S. Geological Survey quadrangle sheets were utilized in determining available storage and earthfill requirements. Field surveys of valley sections of structure centerlines were also made.

Surface and seismic investigations were made to determine geologic conditions. No serious geologic problems are anticipated.

All structures were flood routed in accordance with procedures outlined in Chapter 21, Section 4, National Engineering Handbook. Several principal spillways and emergency spillway sizes were flood routed to determine the most economical structures.

Channel work in the form of clearing and snagging was proposed on several reaches in the watershed as part of the original plan. However, in the spring of 1974 Soil Conservation Service personnel collected samples of material from these channels and found that they would not satisfy the tractive force requirements in Technical Release 25 for a stable channel. It was also determined that modifications of the proposed channel work (e.g. grade control structures) were not feasible; therefore, the proposed clearing and snagging work was dropped from the plan.

Geology

Preliminary geologic investigations were made on all structure sites proposed in the plan. Investigations consisted of a study of all available literature, aerial photographs of the region, and a thorough surface examination of field conditions. On Structure Nos. 7A, 22, 23, and 2 seismic surveys were made to confirm the surface investigations. All preliminary information gathered and recorded indicates that no unusual geologic problems will be encountered and that the sites are suitable for the proposed dams. Geologic investigations were also made in connection with the proposed work for the purpose of determining various parameters of channel soils needed for tractive force analysis.

Sediment

Determination of sediment damages was accomplished by field examination of the entire flood plain area. Rates of soil movement and sediment production from sheet erosion were determined by using Musgrave's^{1/} formula, which takes into account soil decline, percent of slope, length of slope, rainfall, and cover conditions. Data for the formula were obtained from

1/ Musgrave, G. W., The Quantitative Evaluation of Factors in Water Erosion. Journal of Soil and Water Conservation.

measures of soil surveys of the watershed. Rates of erosion were determined for each land use. Cover factors used in the determination of future rates of soil movement were computed from anticipated use of the land in the future. Sediment storage was computed for structures proposed in the plan. An analysis was made of the cover complex, sheet erosion and channel erosion in the watershed controlled by each structure. The total soil movement was determined and appropriate delivery ratios were applied to calculate sediment storage requirements.

Economics

Methods used in making the economic investigations and analyses followed those approved by the Soil Conservation Service for the benefit-cost evaluation of land and water resource projects. Basic data were obtained from local farmers, Department of Agriculture publications and other sources.

Adjusted normalized prices were used for all agricultural benefit computations. Benefits to roads, bridges, reservoirs, and industrial water supply were based on 1974 prices and were adjusted to long term values in accordance with Chapter 15 of the Economics Guide. Operation and maintenance costs were based on 1974 prices. Installation costs were based on 1974 prices. The costs of all structural measures were amortized over a 100-year period, using an interest rate of 5-7/8 percent.

Land use and yield information was obtained from the owners and operators of approximately 25 percent of the flood plain acreage in the watershed, other farmers in the watershed, and from the Rutherford County District Conservationist.

The yields used in calculating more intensive land use benefits are those expected using good management and technology. The planned land use is within the capabilities of the flood plain soils.

Expected gross returns provide the basis for determining damage factors for crops and pasture. When crops are destroyed by floodwater, the unexpended costs of production are subtracted from expected gross returns in calculating damage factors. In calculating floodwater damages, damage factors are applied by computer to the damageable values obtained with the land use and yields estimated for the future without project.

Damages to other agricultural improvements are calculated by computer, based on an estimated damage per acre inundated. The calculations of floodwater damages make use of the frequency of flooding method of hydrological analysis.

Benefit reduction, restoration of former productivity, and more intensive land use benefits were claimed on 3,047 acres of flood plain land downstream from structures. There are 1,637 acres of flood plain land downstream from the structures on which benefits were not evaluated, since it is projected that these areas will remain in woods, or will be used for farm roads, buildings, ditches, and other purposes.

Investigations

Sediment reduction benefits to land were based on the expected recovery of damaged land. These benefits were discounted where necessary for the length of the recovery period. Benefits were also calculated for prevention of land damage in the future with project and appropriately discounted. Benefits to reservoirs and industrial water supply were based on decreased costs of water treatment and sediment removal from reservoirs.

More intensive land use benefits were estimated on the basis of increased income from higher production resulting from reduced flooding hazard.

Indirect benefits were estimated to be 20 percent of non-agricultural benefits, plus 10 percent of remaining benefits.

Redevelopment benefits were estimated in accordance with Chapter 12 of the Economics Guide and paragraph 102.02212 of the Watershed Protection Handbook.

Wage payments to local labor during construction were estimated to be 20 percent of the construction cost. This value was amortized at 5-7/8 percent interest for 100 years to arrive at annual redevelopment benefits. Fifty percent of operation and maintenance cost was used as the value of wages paid to local labor. This value was treated as a decreasing annuity for 20 years at 5-7/8 percent interest and converted to an annual equivalent over the life of the project.

Local secondary benefits were estimated in accordance with paragraph 102.02213 of the Watershed Protection Handbook and Chapter 11 of the Economics Guide. The value of local secondary benefits, stemming from the project, was estimated to be 10 percent of the direct primary benefits. Indirect benefits were excluded when computing secondary benefits. The value of local secondary benefits induced by the project was estimated to be 10 percent of the increased cost that primary producers will incur in connection with increased production.

Recreation benefits from Structure No. 3A were estimated on a basis of 17,000 visitor-days annually, valued at \$1.00 per visitor-day. Sanitary facilities will be provided at this site.

Recreation benefits from Structure No. 2 were estimated at \$203,000 annually, based on 135,000 visitor-days. Visitor-days are valued at \$1.50 since this site will have a recreation development.

The sponsors estimated the value of the land rights to be \$1,545,200. Costs of relocation payments were estimated in accordance with provisions of Watersheds Memorandum-110.

Biology

A biology field review was conducted by district biologists from N. C. Wildlife Resources Commission, the U. S. Fish and Wildlife Service, and

Investigations

the Soil Conservation Service. This was a team effort to determine the present fish and wildlife resources, potential for improvement, and possibilities of damage that could require mitigating. Other data, including the Catalog of the Inland Fishing Waters in North Carolina, prepared by the N. C. Wildlife Resources Commission, were considered.

Forestry

A systematic field survey showed ground cover, forest and hydrologic condition and treatment needs. The survey, supporting data, and information from other agencies and forestry officials, determined the amount of remedial measures. The effects of the proposed works of improvement on fire hazard and risk were analyzed. The recommended measures will contribute to flood reduction and soil stabilization, and can reasonably be accomplished during the installation period.

Land Use and Treatment

Present land use was determined from soil surveys, soil and water conservation district reports, and field studies. Estimates of future land use and treatment measures were made by the district conservationists on the basis of their knowledge of the land, people, and present trends in the watershed area. Needed land use adjustments based on land capabilities were considered in arriving at the land treatment measures for the watershed.

Cultural Resources

Studies to determine the extent of the cultural resource base, and to identify properties that may be eligible for inclusion in the National Register of Historic Places, were conducted through cooperative efforts with the North Carolina Department of Cultural Resources, Division of Archives and History. The report, "An Archaeological Survey of the Upper Second Broad Watershed, McDowell and Rutherford Counties, North Carolina," recommended test excavations on six sites which warrant further investigations at a cost of about \$12,000.

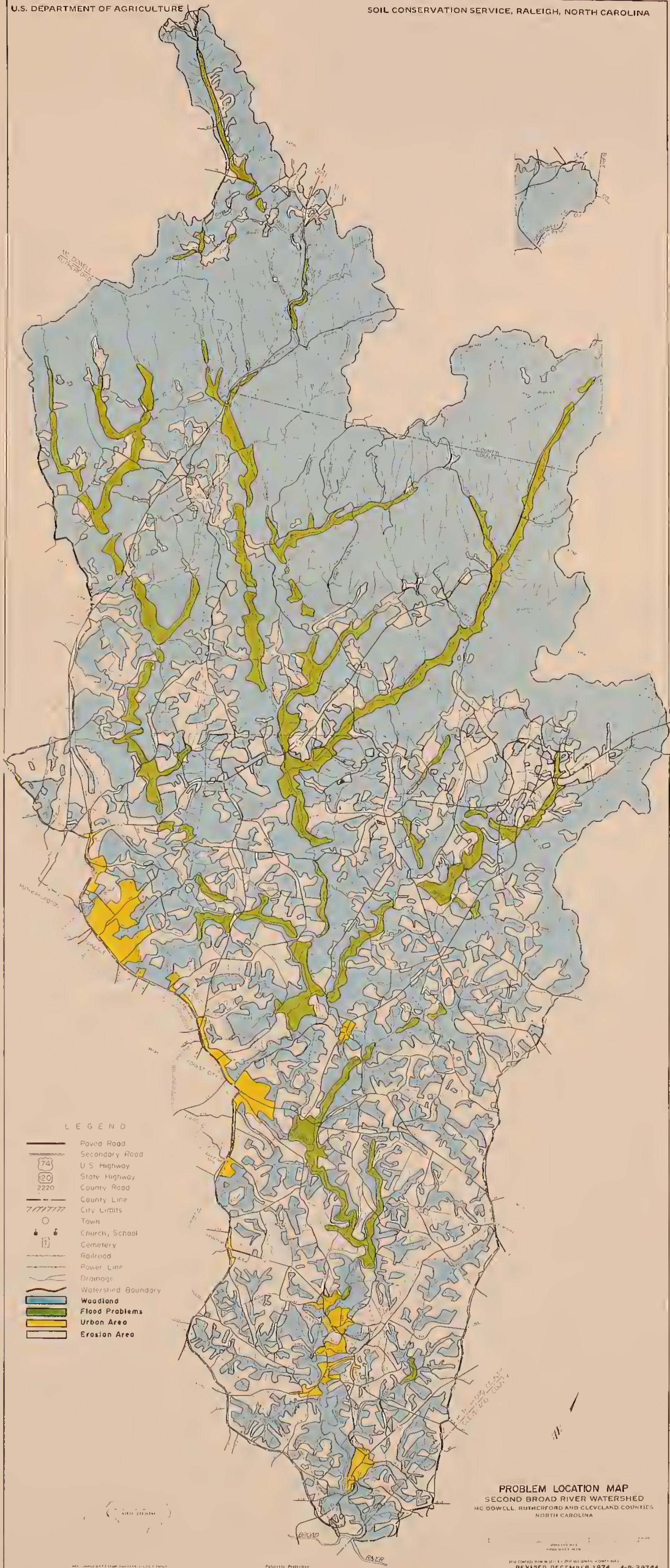
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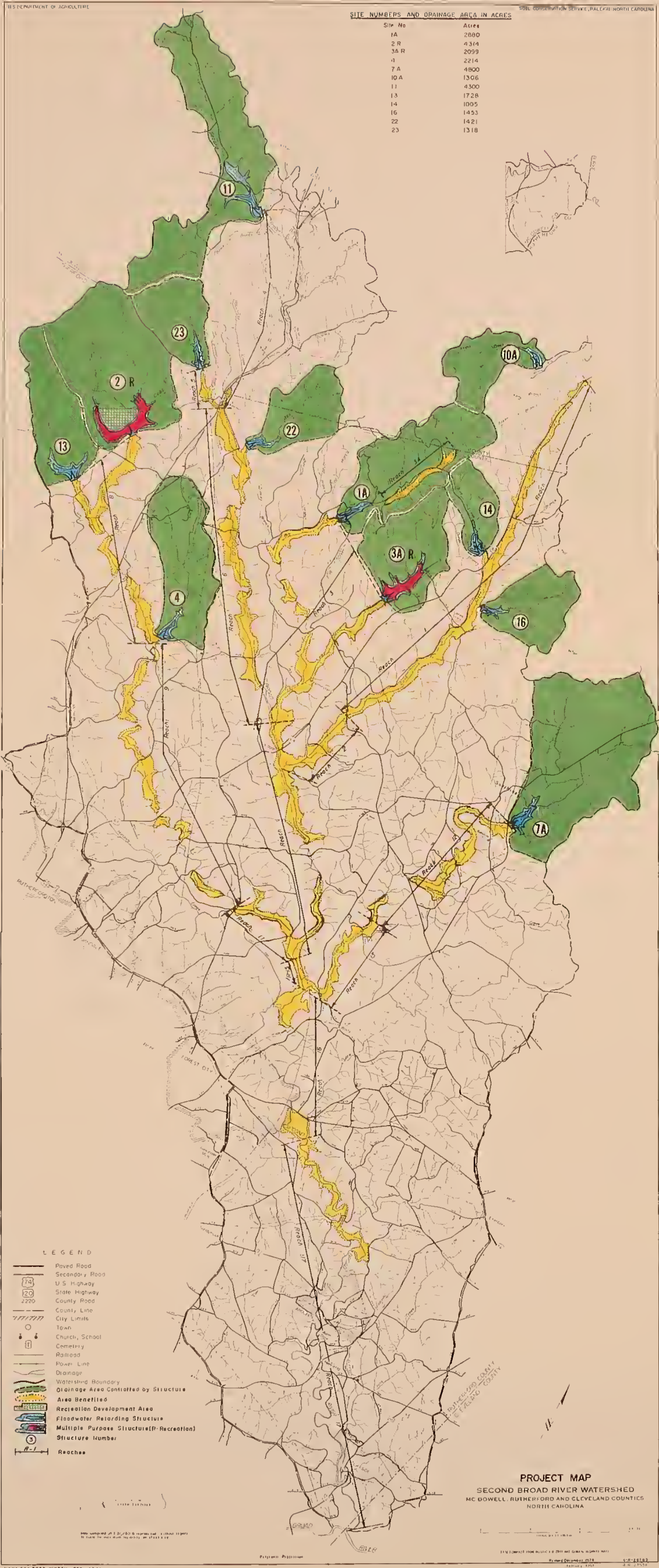
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PROJECT MAP
SECOND BROAD RIVER WATERSHED
MC DOWELL, RUTHERFORD AND CLEVELAND COUNTIES
NORTH CAROLINA





